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AH500 Module Manual

AH500 Module Manual

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Chapter 1 Introduction

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1.1 Overview

This manual introduces the usage of special modules. Analog input/output modules, temperature measurement modules, motion control modules, and network modules are special modules. They are described below.

Classification	Model Name	Description
Ana log input/output module	AH04AD-5A	Four-channel analog input module 16-bit resolution 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH08AD-5B	Eight-channel analog input module 16-bit resolution 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V Conversion time: 150 us/channel
	AH08AD-5C	Eight-channel analog input module 16-bit resolution 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH04DA-5A	Four-channel analog output module 16-bit resolution 0/1V~5V , -5V~5V , 0V~10V , -10V~10V 0/4mA~20mA Conversion time: 150 us/channel
	AH08DA-5B	Eight-channel analog output module 16-bit resolution 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V Conversion time: 150 us/channel
	AH08DA-5C	Eight-channel analog output module 16-bit resolution 0/4 mA~20 mA Conversion time: 150 us/channel
	AH06XA-5A	Four-channel analog input module 16-bit resolution 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel Two-channel analog output module 16-bit resolution 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel

Classification	Model Name	Description
Temperature measurement module	AH04PT-5A	Four-channel four-wire/three-wire RTD temperature sensor Sensor type: Pt100/Pt1000/Ni100/Ni1000 sensor, and 0~300 Ω input impedance Resolution: 0.1 ℃/0.1 ℉ Four-wire conversion time: 150 ms/channel Three-wire conversion time: 300 ms/channel
	AH04TC-5A	Four-channel thermocouple temperature sensor Sensor type: J, K, R, S, T, E, N, B, and -150~+150 mV Resolution: 0.1 ℃/0.1 ℉ Conversion time: 200 ms/channel
	AH08TC-5A	Eight-channel thermocouple temperature sensor Sensor type: J, K, R, S, T, E, N, B, and -150~+150 mV Resolution: 0.1 ℃/0.1 ℉ Conversion time: 200 ms/channel
Motion control module	AH02HC-5A	Two-channel high-speed counter module 200 kHz
	AH04HC-5A	Four-channel high-speed counter module 200 kHz
Network module	AH10EN-5A	It is an Ethernet master module with two built-in Ethernet ports, and supports a Modbus TCP master.
	AH10SCM-5A	It is a serial communication module with two RS-485/RS-422 ports, and supports Modbus and the UD Link protocol. There is isolation between two parts of communication, and there is isolation between two parts of power.
	AH10DNET-5A	It is a DeviceNet network module. It can function as a master or a slave. The maximum communication speed is 1 Mbps.

1.2 Specifications

1.2.1 General Specifications

Item	Specifications
Operating temperature	-20~60°C
Storage temperature	-40~70°C
Operating humidity	5~95% No condensation
Storage humidity	5~95% No condensation
Vibration/Shock resistance	International standards IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)
Work environment	No corrosive gas exists.
Installation location	In a control box
Pollution degree	2

1.2.2 EMC Standards

1.2.2.1 EMI

Port	Frequency range	Level (Normative)	Reference standard
Enclosure port (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB (μV/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μV/m) quasi-peak	
AC power port (conducted)	0.15-0.5 MHz	79 dB (μV) quasi-peak	IEC 61000-6-4
		66 dB (μV) average	
	0.5-30 MHz	73 dB (μV) quasi-peak	
		60 dB (μV) average	

1.2.2.2 EMS

Environmental phenomenon	Reference standard	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		±4kV
		Air		±8kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	2.0-2.7 GHz	1 V/m
			1.4-2.0 GHz	3 V/m
			80-1000 MHz	10 V/m
Power frequency magnetic field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

1.2.2.3 Conducted Immunity Test

Environmental phenomenon		Fast transient burst	High energy surge	Radio frequency interference
Reference standard		IEC 61000-4-4	IEC 61000-4-5	IEC 61000-4-6
Interface/Port	**Specific interface/port**	**Test level**	**Test level**	**Test level**
Data communication	Shielded cable	1 kV	1 kV CM	10 V
	Unshielded cable	1 kV	1 kV CM	10 V
Digital and analog I/O	AC I/O (unshielded)	2 kV	2 kV CM 1 kV DM	10 V
	Analog or DC I/O(unshielded)	1 kV	1 kV CM	10 V
	All shielded lines (to the earth)	1 kV	1 kV CM	10 V
Equipment power	AC power	2 kV	2 kV CM 1 kV DM	10 V
	DC power	2 kV	0.5 kV CM 0.5 kV DM	10 V
I/O power and auxiliary power output	AC I/O and AC auxiliary power	2 kV	2 kV CM 1 kV DM	10 V
	DC I/O and DC auxiliary power	2 kV	0.5 kV CM 0.5 kV DM	10 V

MEMO

Chapter 2 Analog Input Module AH04AD-5A/AH08AD-5B/AH08AD-5C

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2.1 Overview

The specifications for analog-to-digital modules, the operation, and the programming are described in this chapter. AH04AD-5A and AH08AD-5B are analog-to-digital modules.

2.1.1 Characteristics

2

(1) **A module is selected according to practical application.**
AH04AD-5A: There are four channels. Inputs received by a channel can be either voltages or currents.
AH08AD-5B: There are eight channels. Inputs received by these channels are voltages.
AH08AD-5C: There are eight channels. Inputs received by these channels are currents.

(2) **High-speed conversion**
An analog signal is converted into a digital signal at a speed of 150 μs a channel.

(3) **High accuracy**
Conversion accuracy: The error is ±0.02% of an input voltage, and ±0.05% of an input current. (The ambient temperature is 25°C.)

(4) **A scale range can be set by means of software.**
Users can set a scale range in ISPSoft. A scale range is a range of digital values to which a range of analog values corresponds.

(5) **A module can be set by means of utility software.**
HWCONFIG is built-in utility software in ISPSoft. Users can set modes and parameters in HWCONFIG to complete hardware configuration without spending time writing a program to set registers corresponding to functions.

2.2 Specifications and Functions

2.2.1 Specifications

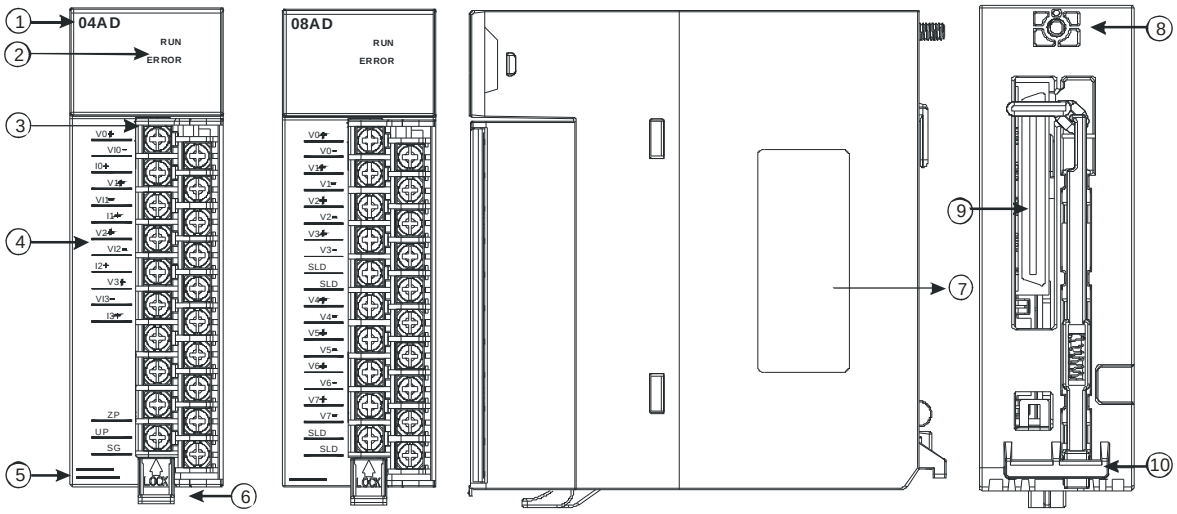
Electrical specifications

Module name	AH04AD-5A	AH08AD-5B	AH08AD-5C
Number of inputs	4	8	8
Analog-to-digital conversion	Voltage input/Current input	Voltage input	Current input
Supply voltage	24 V DC (20.4 V DC~28.8 V DC) (-15%~+20%)		
Connector type	Removable terminal block		
Overall accuracy	25°C (77°F): The error is ±0.02% of an input voltage, and ±0.05% of an input current. -20~60°C (-4~140°F): The error is ±0.15% of an input voltage, and ±0.8% of an input current.		
Conversion time	150 μs/channel		
Isolation	There is isolation between an analog circuit and a digital circuit, but there is no isolation between analog channels. Isolation between a digital circuit and a ground: 500 V DC Isolation between an analog circuit and a ground: 500 V DC Isolation between an analog circuit and a digital circuit: 500 V DC Isolation between the 24 V DC and a ground: 500 V DC		

Functional specifications

Analog-to-digital conversion	Voltage input				
Rated input range	-10 V~10 V	0 V~10 V	±5 V	0 V~5 V	1 V~5 V
Hardware input range	-10.1 V~10.1 V	-0.1 V~10.1 V	-5.05 V~5.05 V	-0.05 V~5.05 V	0.95 V~5.05 V
Fiducial error (25°C)	±0.02%	±0.01%	±0.02%	±0.02%	±0.02%
Linearity error	±0.02%	±0.03%	±0.01%	±0.01%	±0.02%
Hardware resolution	16 bits				
Input impedance	>200 kΩ				
Absolute input range	±15 V				
Analog-to-digital conversion	Current input				
Rated input range	±20 mA	0m A~20 mA	4 mA~20 mA		
Hardware input range	-20.2 mA~20.2 mA	-0.2 mA~20.2 mA	3.8 mA~20.2 mA		
Fiducial error (25°C)	±0.04%	±0.05%	±0.02%		
Linearity error	±0.01%	±0.01%	±0.02%		
Hardware resolution	16 bits				
Input impedance	250 Ω				
Absolute input range	±32 mA				

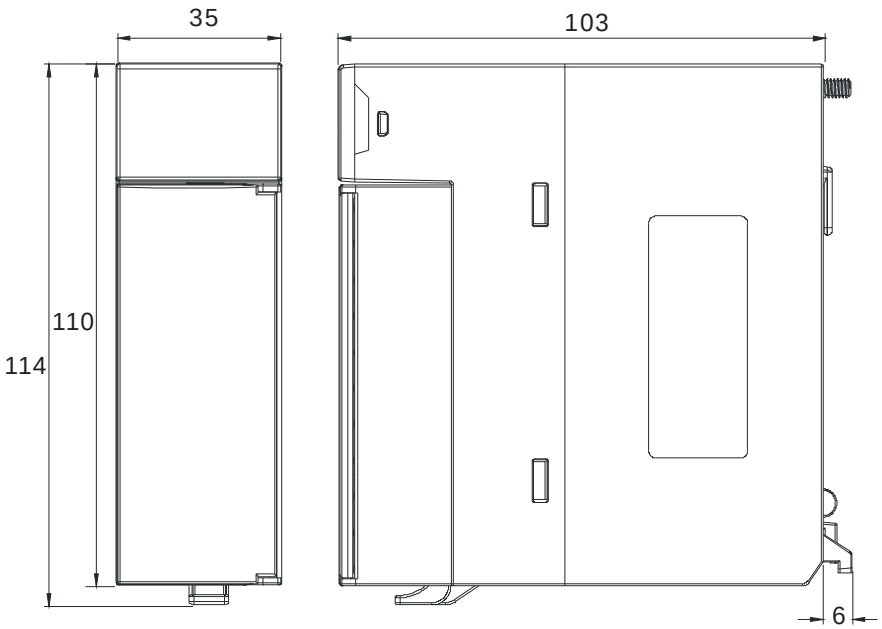
2.2.2 Profile



Number	Name	Description
1	Model name	Model name of the module

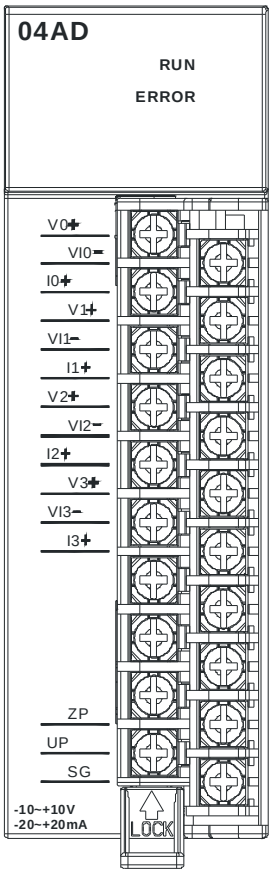
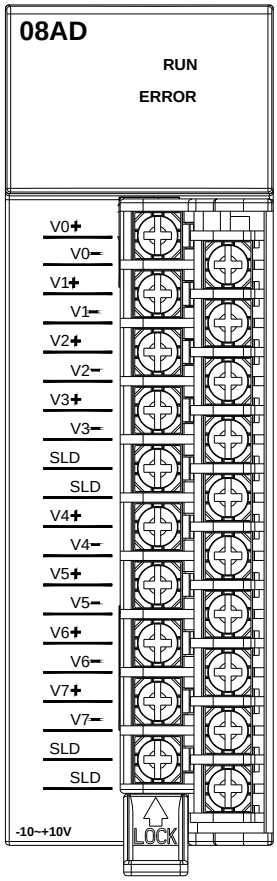
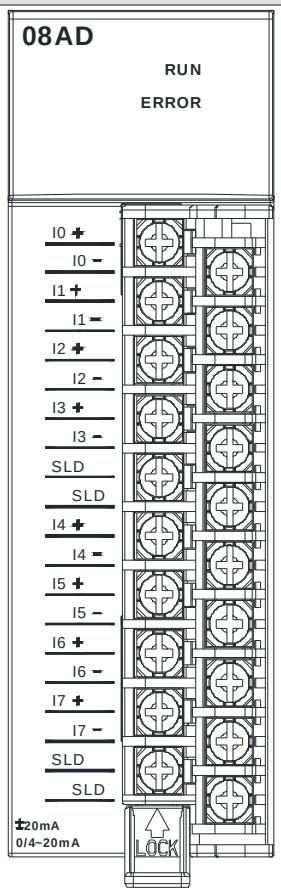
Number	Name	Description
2	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.
3	Removable terminal block	The inputs are connected to sensors.
4	Arrangement of the input terminals	Arrangement of the terminals
5	Description of the inputs	Simple specifications for the module
6	Clip	Removing the terminal block
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

2.2.3 Dimensions



Unit: mm

2.2.4 Arrangement of Terminals

AH04AD-5A	AH08AD-5B	AH08AD-5C
		

2.2.5 Functions

HWCONFIG, built-in utility software in ISPSoft, can be used to set a module. Users can set modes and parameters by means of HWCONFIG.

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Calibration	Users can calibrate a linear curve.
3	Average	Conversion values are averaged and filtered.
4	Scale range	An analog range corresponds to a digital range.
5	Disconnection detection	Only if the analog rang is 4 mA~20 mA or 1 V~5 V does the disconnection detection function.
6	Channel detection	If an input signal exceeds a range of inputs which can be received by hardware, the module will give an alarm or a warning. a. Warning LED indicator: When a warning occurs, the ERROR LED indicator blinks or does not blink. b. Interrupt: An interrupt service routine is enabled.

1. Enabling/Disabling a channel

An analog signal is converted into a digital signal at a speed of 150 μs a channel. The total conversion time is 150 μs×(the number of channels). If a channel is not used, users can disable it to decrease the total conversion time.

2. Calibration

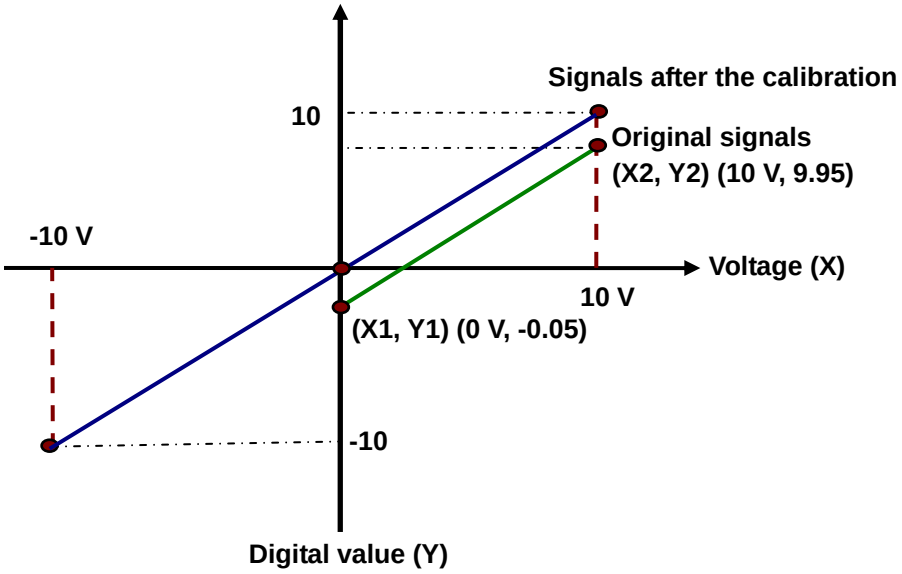
- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of inputs which can be received by hardware.
- A volt is a unit of calibration for offsets if inputs received are voltages. A milliampere is a unit of calibration for offsets if inputs received are currents.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

Example 1:

The inputs received by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. The voltage received by the channel is 0 V, and the digital value is -0.05. The voltage received by the channel is 10.0 V, and the digital value is 9.95. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[9.95-(-0.05)]/(10-0)=1
Gain used for calibration=1/Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1= -0.05
Offset used for calibration=0-Y1=0.05



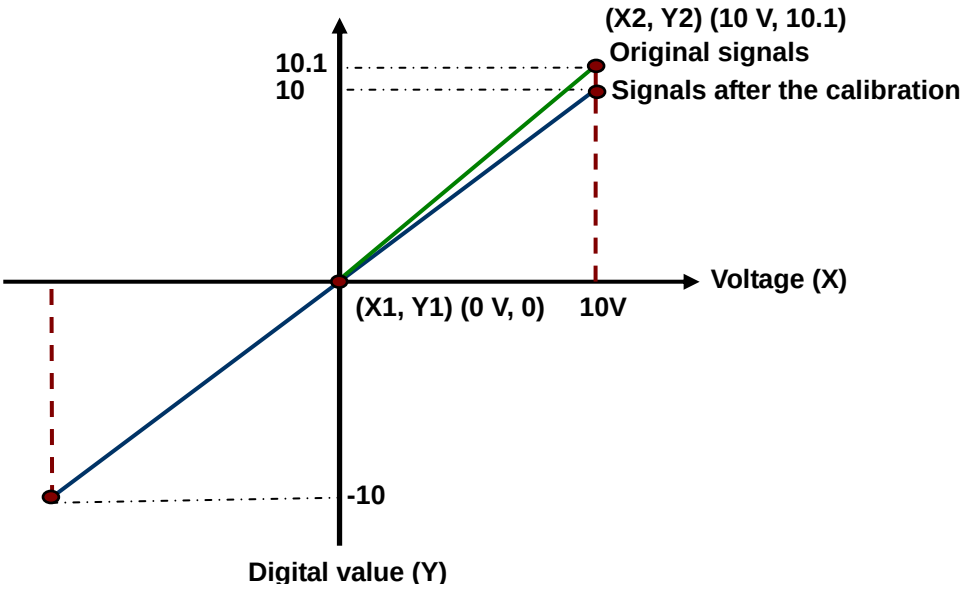
(X: Analog signal; Y: Digital value)

Example 2:

The inputs received by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. If the voltage received by the channel is 0 V, the digital value is 0.0. If the voltage received by the channel is 10.0 V, the digital value is 10.1. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[10.1-0]/(10-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



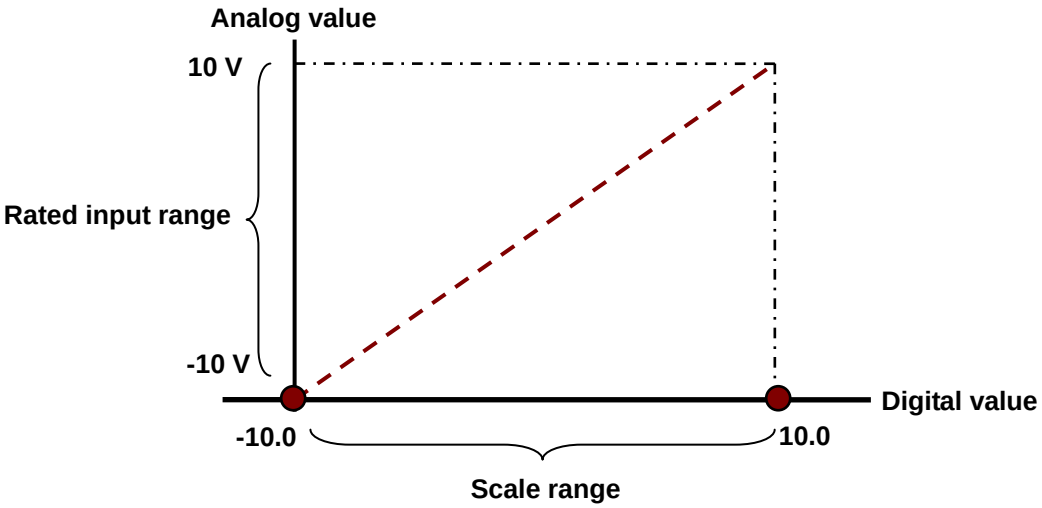
(X: Analog signal; Y: Digital value)

3. Average

Digital values are averaged. The number by which the sum of several digital values is divided is between 1 and 100. The sampled values are taken as a queue, and the length of the queue is N. Each time a new sampled value is put at the end of the queue, an original value at the start of the queue is removed. The N values are averaged so that the periodic noise is suppressed.

4. Scale range

The analog input mode of a channel has a corresponding digital range, that is, an analog range corresponds to a digital range. For example, if the analog range is -10 V~10 V and the digital range is -10.0~10.0, the analog values -10 V~10 V correspond to the digital values -10.0~10.0.



5. Disconnection detection

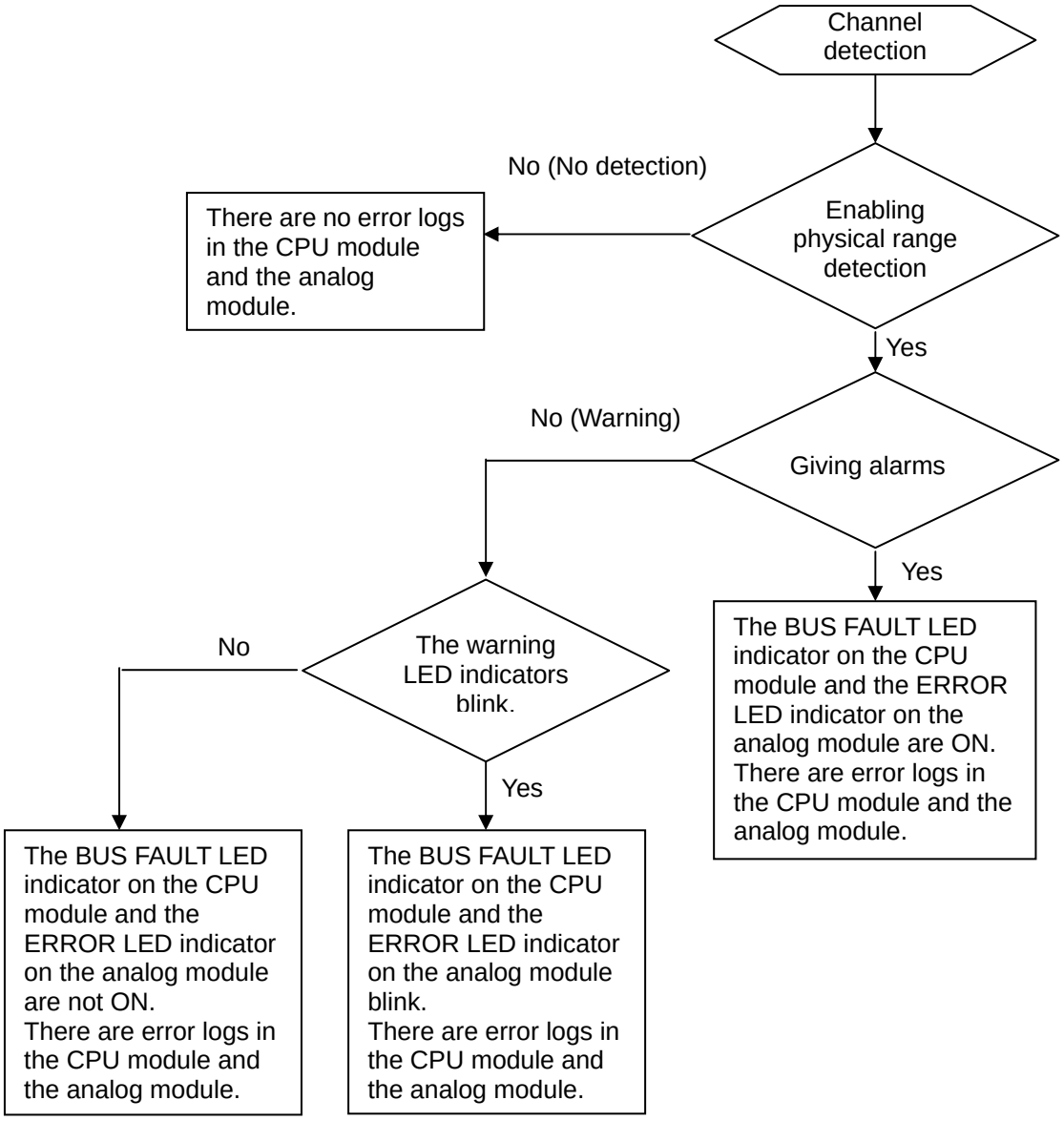
Only if the analog rang is 4 mA~20 mA or 1 V~5 V does the disconnection detection function. If a module which can receive inputs ranging from 4 mA to 20 mA or from1 V to 5V is disconnected, an input signal will exceed the range of inputs which can be received by the hardware, and the module will give an alarm or a warning. Please refer to the description below for more information.

6. Channel detection

If an input signal exceeds a range of inputs which can be received by hardware, an error message appears. Please refer to section 1.2.1 for more information.

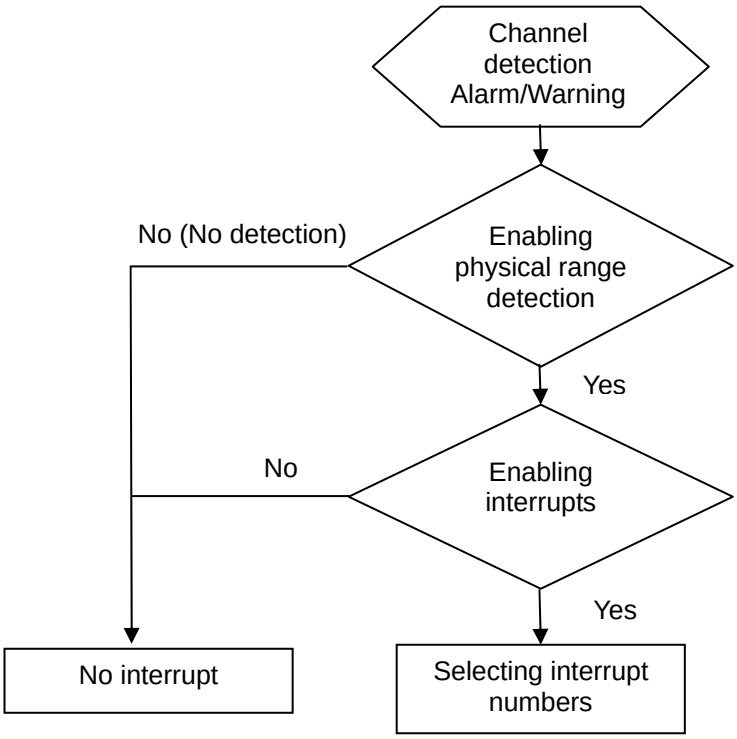
a. Giving alarms or warnings

The procedure below explains how to set a module so that it gives an alarm or a warning.


Channel detection
Enabling physical range detection
No (No detection)
There are no error logs in the CPU module and the analog module.
Yes
Giving alarms
No (Warning)
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module are ON. There are error logs in the CPU module and the analog module.
The warning LED indicators blink.
No
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module are not ON. There are error logs in the CPU module and the analog module.
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module blink. There are error logs in the CPU module and the analog module.

b. Interrupt service routine

The procedure below explains how to trigger an interrupt service routine in a CPU module.



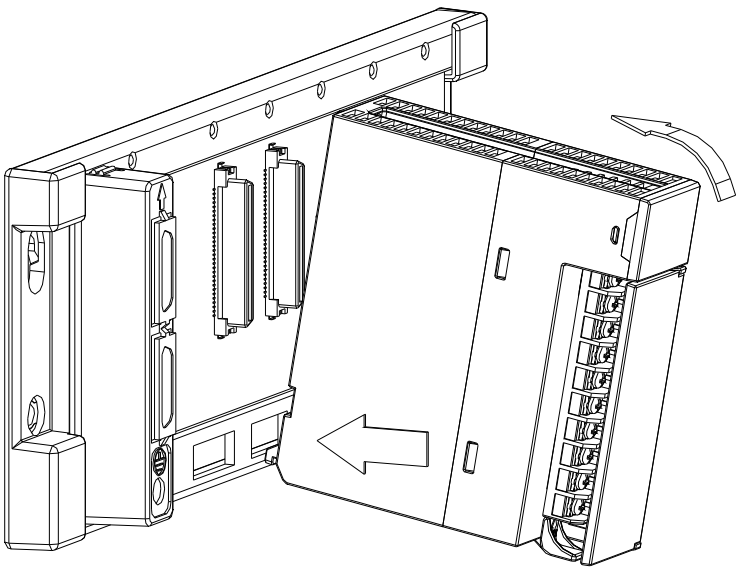
- The interrupt service routines are I40~I251.

2.3 Installation

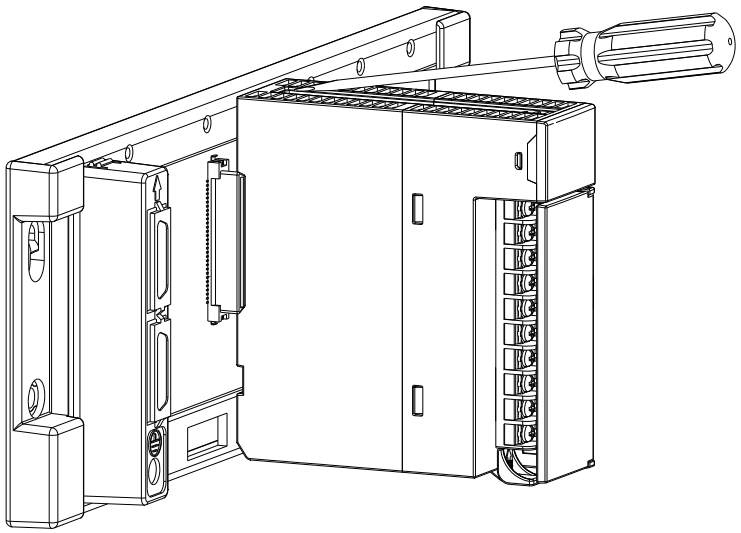
2.3.1 Installing a Module

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.

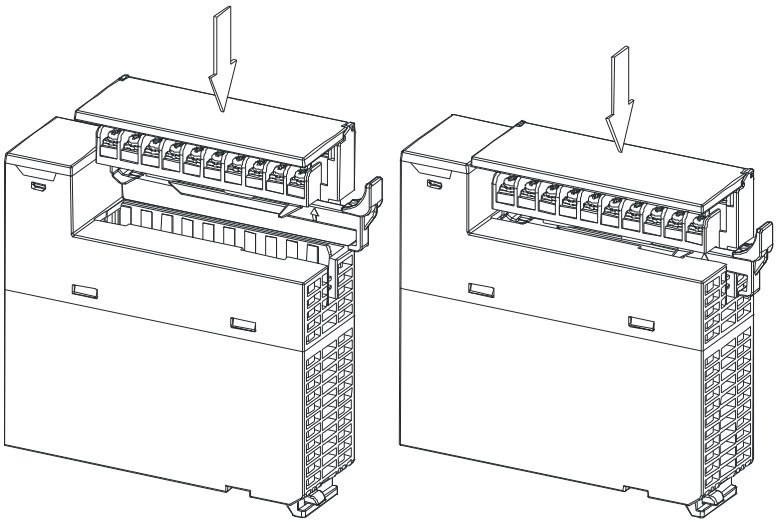


3. Tighten the screw on the module.

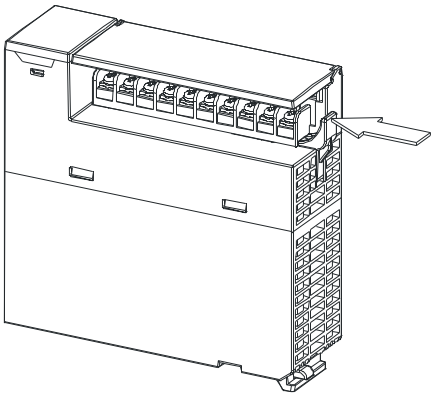


2.3.2 Installing a Removable Terminal Block

- **Installation**
  1. Level a terminal block at the printed circuit board, and press it into the module.

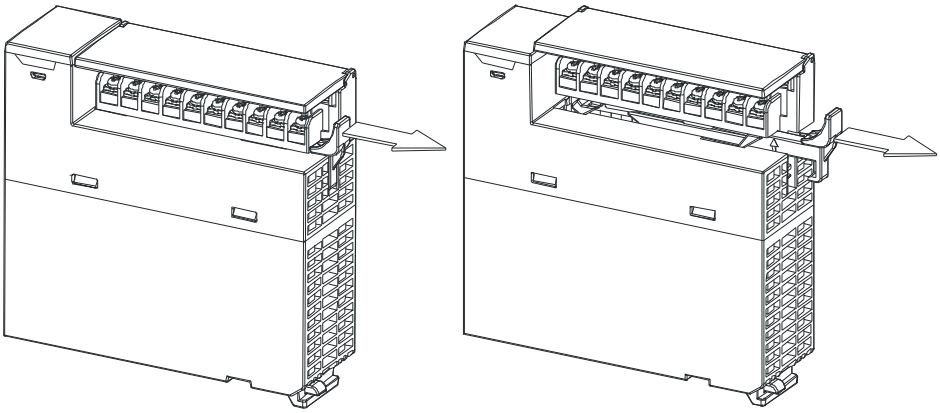


2. Press the clip in the direction indicated by the arrow.

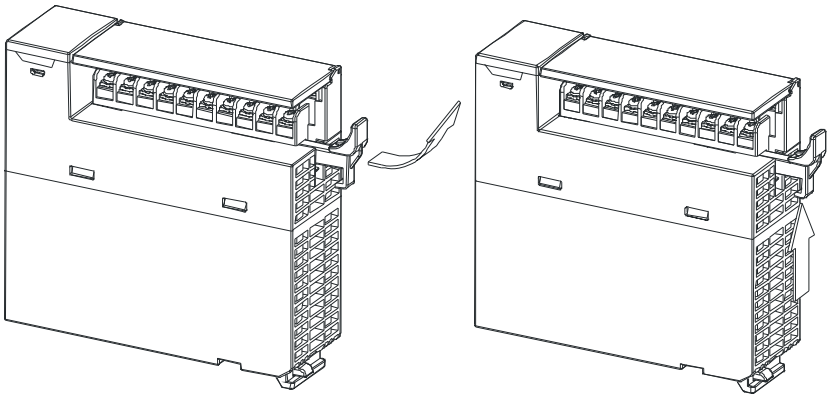


- **Removal**

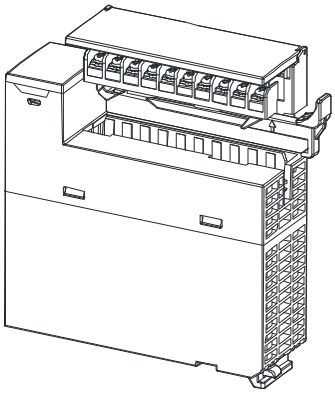
1. Pull the clip in the direction indicated by the arrow.



2. Pull up the clip.



3. The terminal block is removed.



2.3.3 Wiring

- **Precautions**

  In order to make the functions of an analog-to-digital module perfect and ensure the reliability of a system at the same time, external wiring which prevents noise is necessary. Before installing cables, users need to follow the precautions below.

  (1) To prevent a surge and induction, an AC cable and input signal cables which are connected to AH04AD-5A/AH08AD-5B must be separate cables.

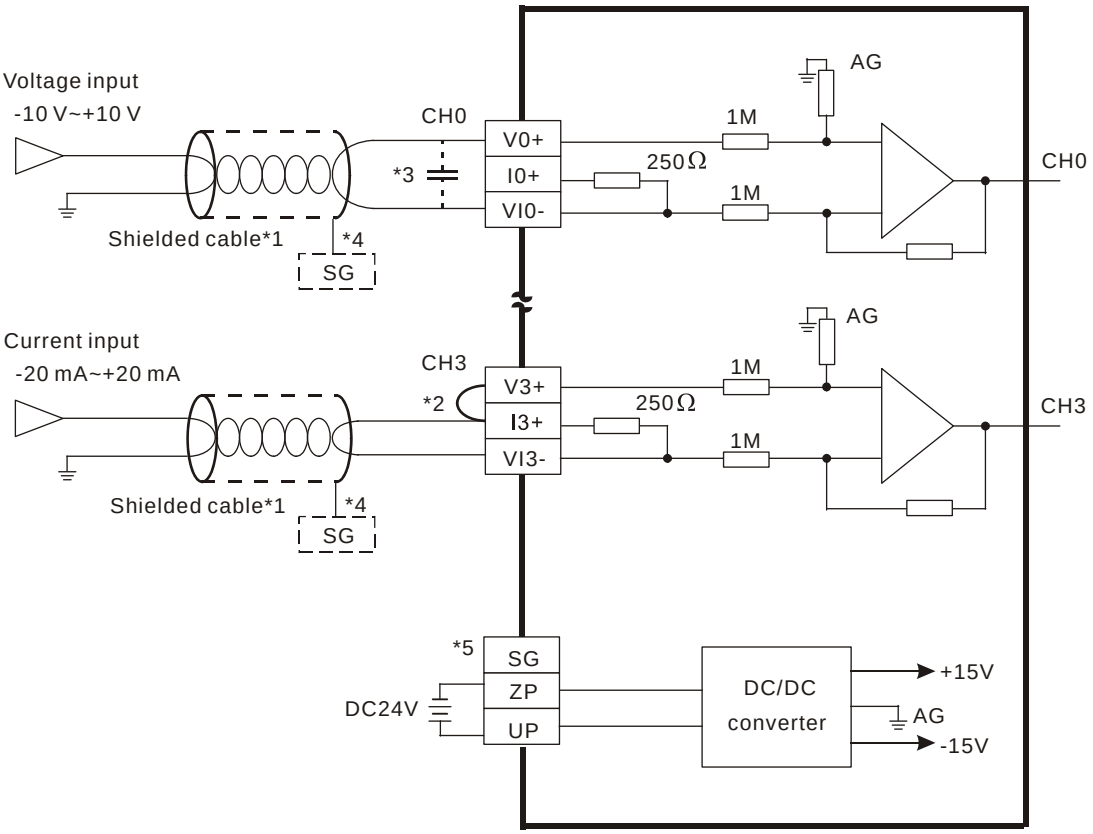
  (2) A cable must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Besides, a cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Otherwise, effects that noise, induction, and a surge have will increase.

  (3) Please connect a shielded cable and a hermetically sealed cable with the ground separately.

  (4) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.

- **External wiring**

(1) AH04AD-5A



*1. Please isolate the analog input signal cables from other power cables.

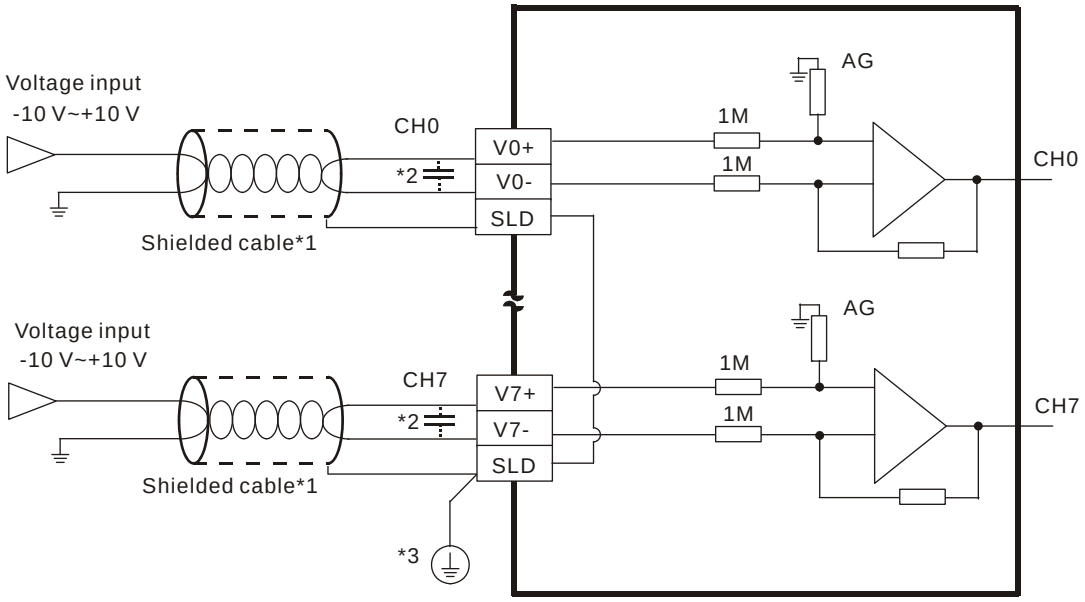
*2. If the module is connected to a current signal, the terminals V+ and I+ have to be short-circuited.

*3. If the ripple in the input voltage results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*4. Please connect the shielded cables to the terminal SG.

*5. Once AH04AD-5A is installed on a backplane, the terminal SG on AH04AD-5A and the terminal ⏚ on the backplane will be short-circuited. Please connect the terminal ⏚ on the backplane to the ground terminal ⏚.

(2) AH08AD-5B



*1. Please isolate the analog input signal cables from other power cables.

*2. If the ripple in the input voltage results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*3. Please connect the terminal SLD to the ground terminal ⏚.

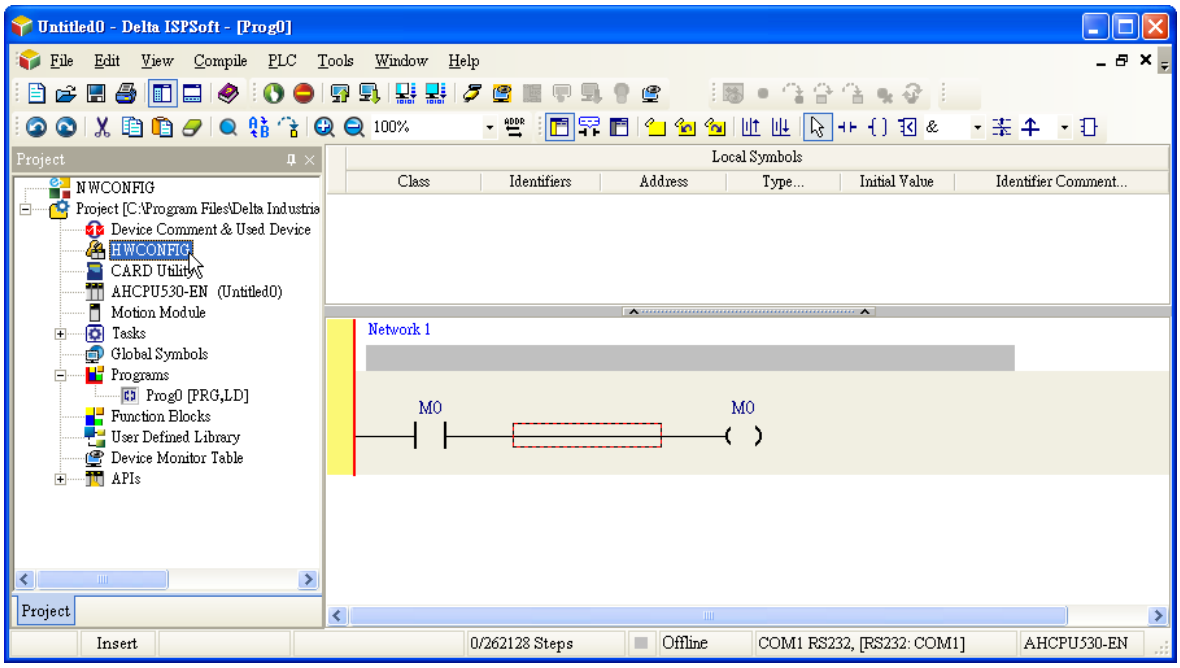
2.3.4 LED Indicators

Number	Name	Description
1	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
2	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.

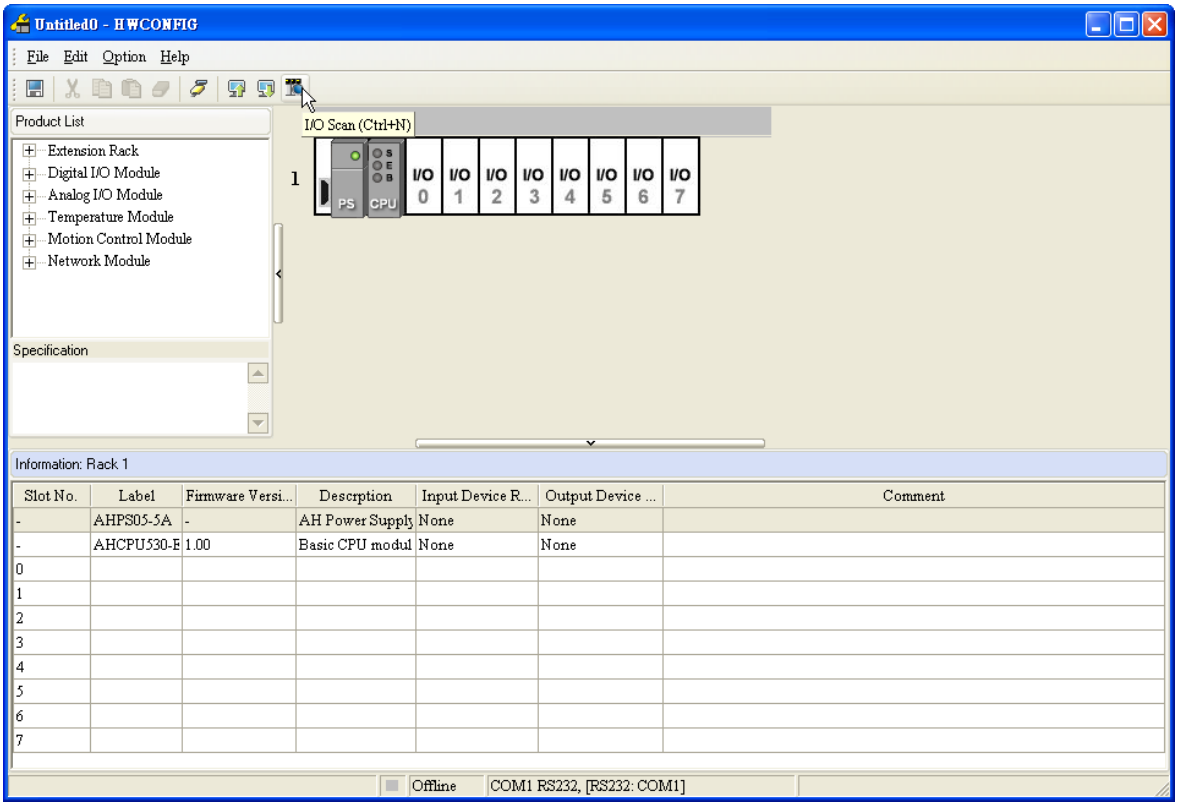
2.4 HWCONFIG in ISPSoft

2.4.1 Initial Setting

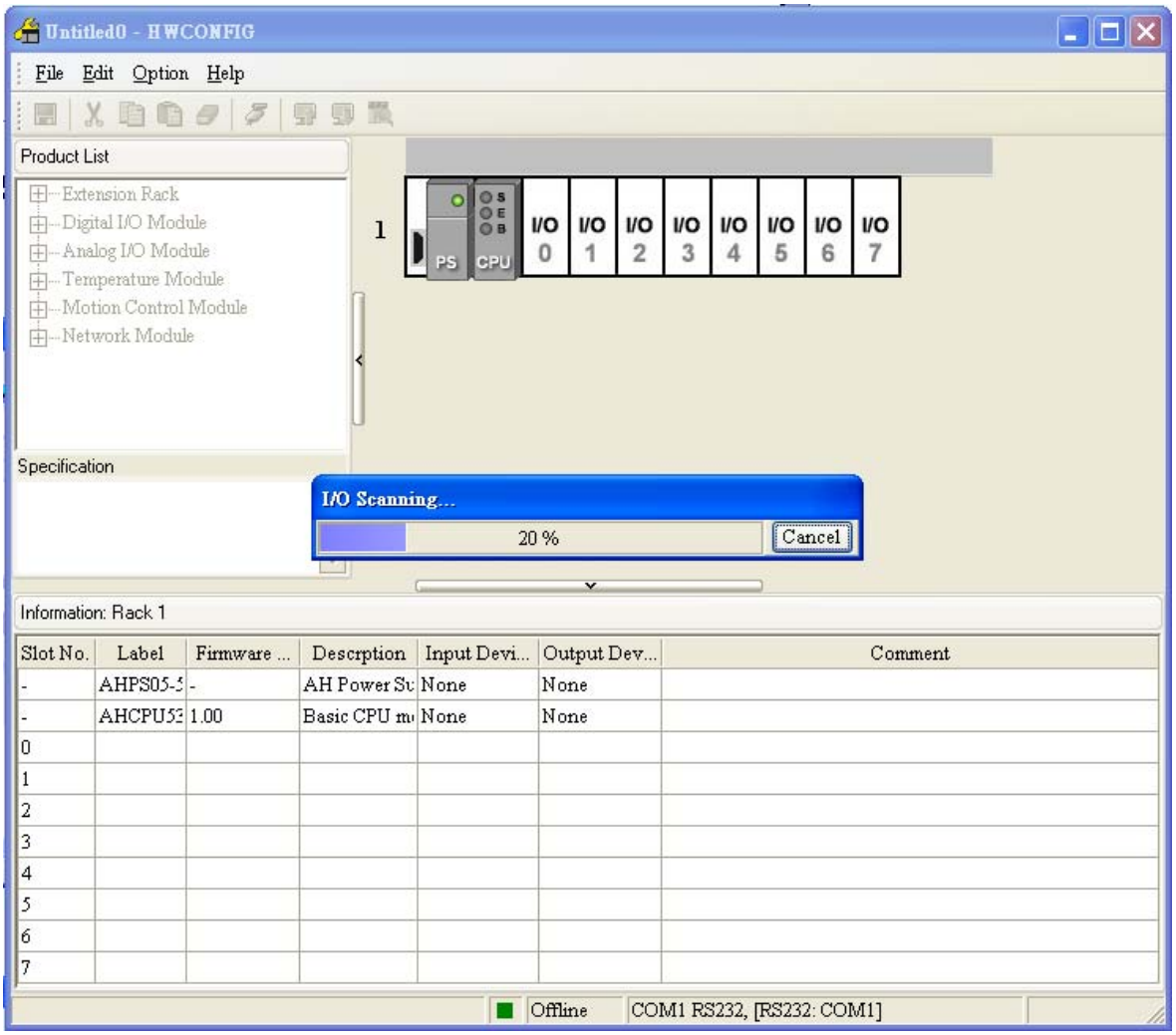
(1) Start ISPSoft, and then double-click **HWCONFIG**.



(2) Click **I/O scan** on the toolbar.

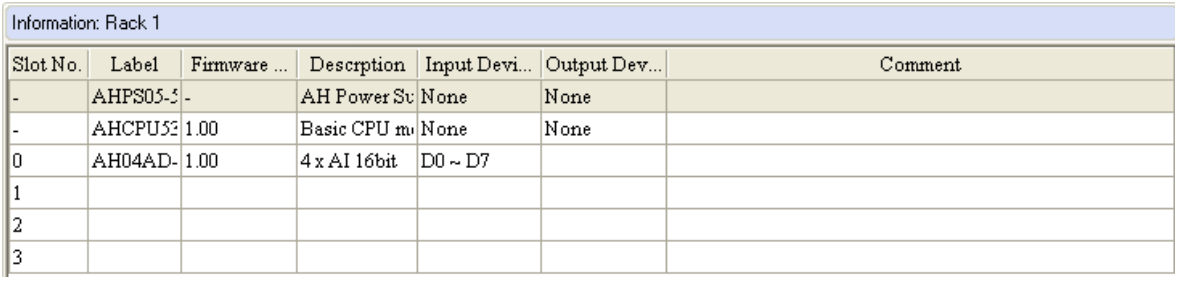


(3) ISPSoft is scanning the actual hardware configuration.

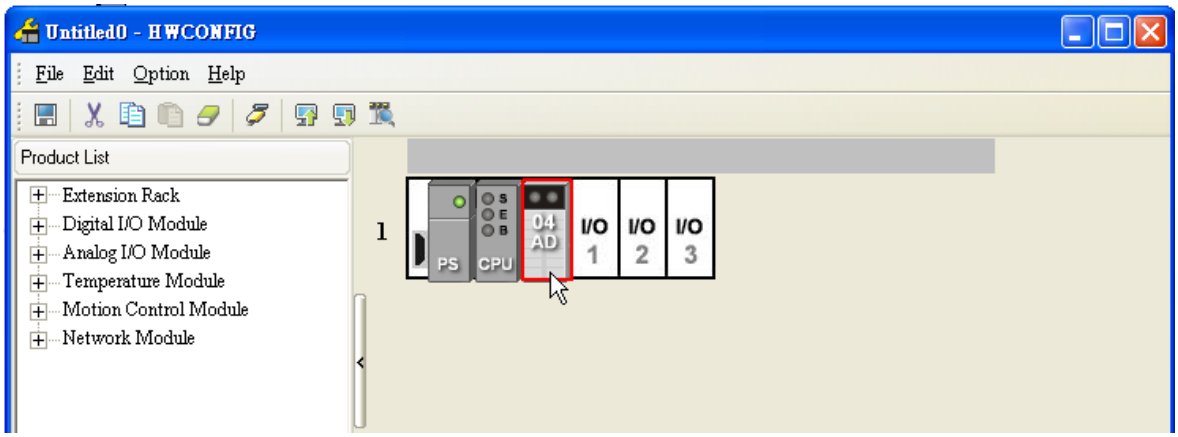


(4) After the scan of the actual hardware configuration is complete, the system automatically assigns the corresponding registers to the channels. Users can alter the input device range by themselves.

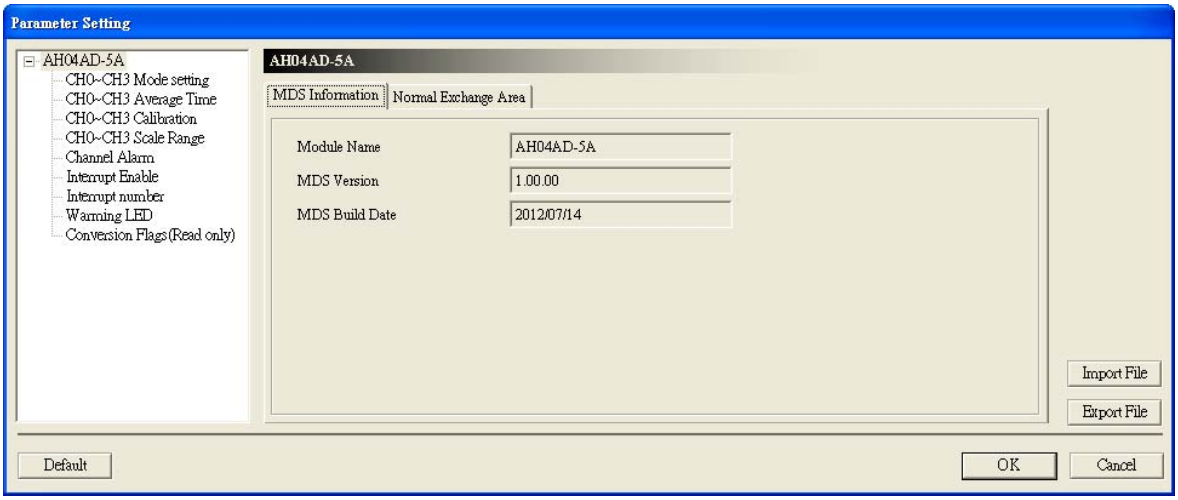
Note: Owing to the fact that values are floating-point numbers, every channel occupies two 16-bit registers.


Information: Rack 1
Slot No. Label Firmware ... Descrption Input Devi... Output Dev... Comment
- AHPS05-5 - AH Power Su None None
- AHCPU53 1.00 Basic CPU m None None
0 AH04AD- 1.00 4 x AI 16bit D0 ~ D7
1
2
3

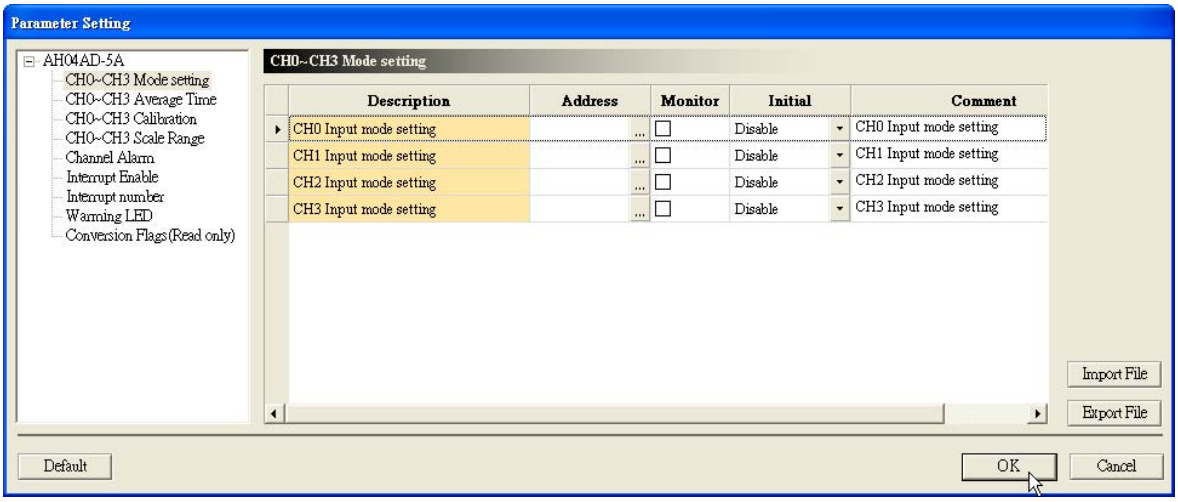
(5) Double-click the module.



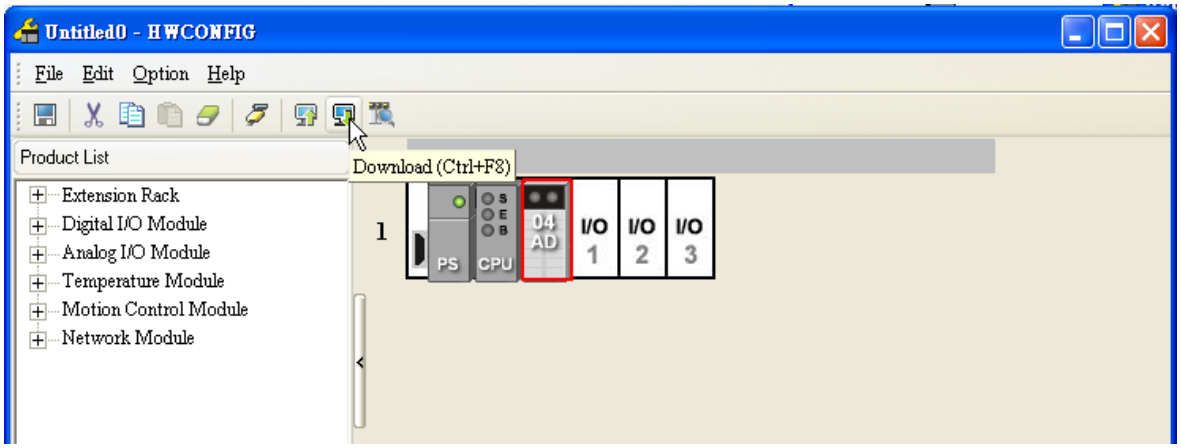
(6) Open the **Parameter Setting** window.



(7) Set the parameters, and then click **OK**.

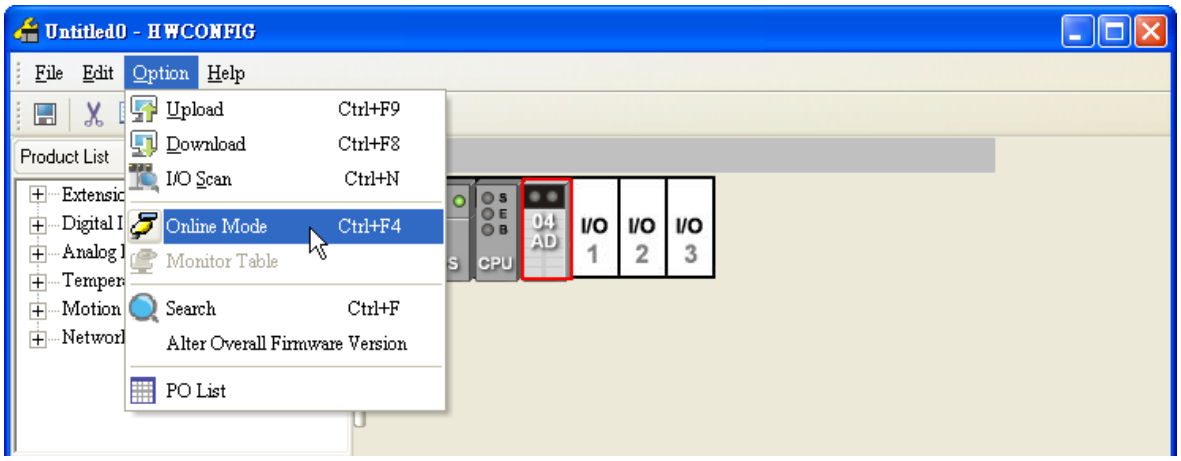


(8) Click **Download** on the toolbar to download the parameters. (The parameters can not be downloaded when the CPU module runs.)

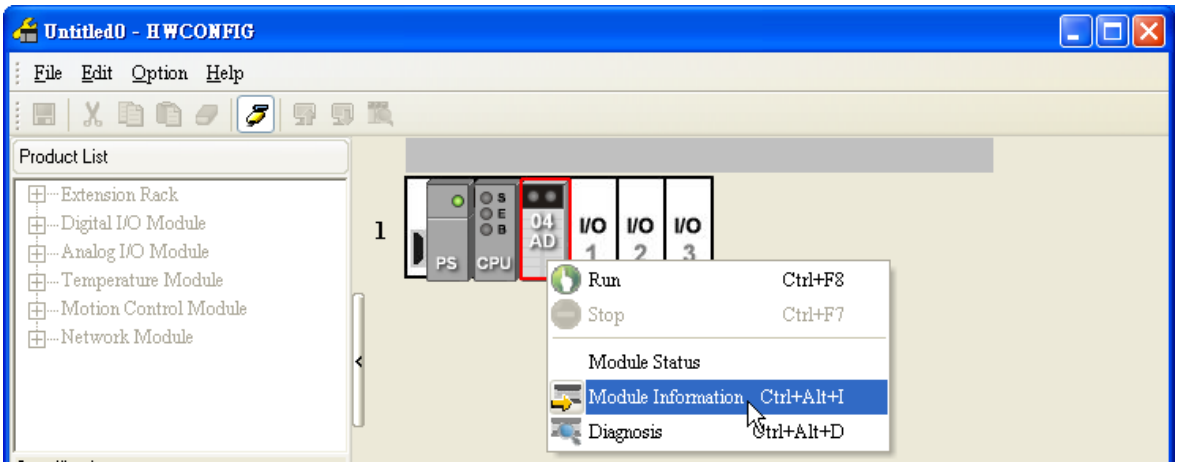


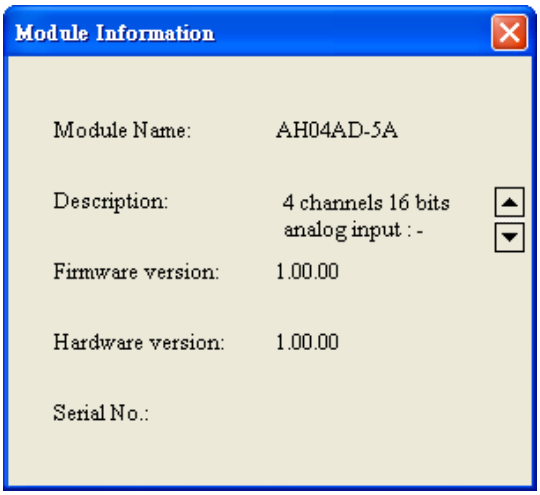
2.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



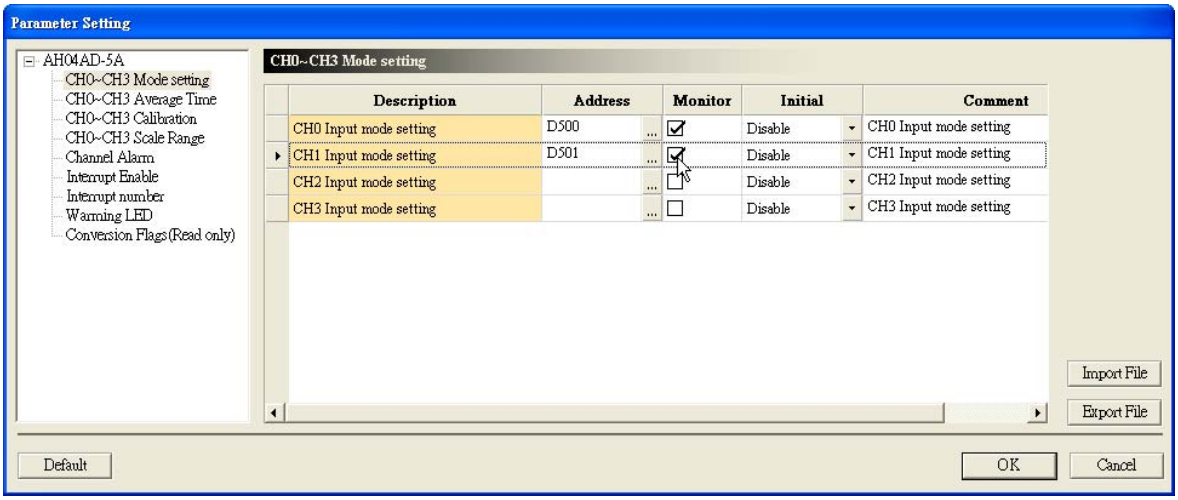
(2) Right-click the module, and then click **Module Information** on the context menu. The version of the firmware and that of the hardware are displayed.



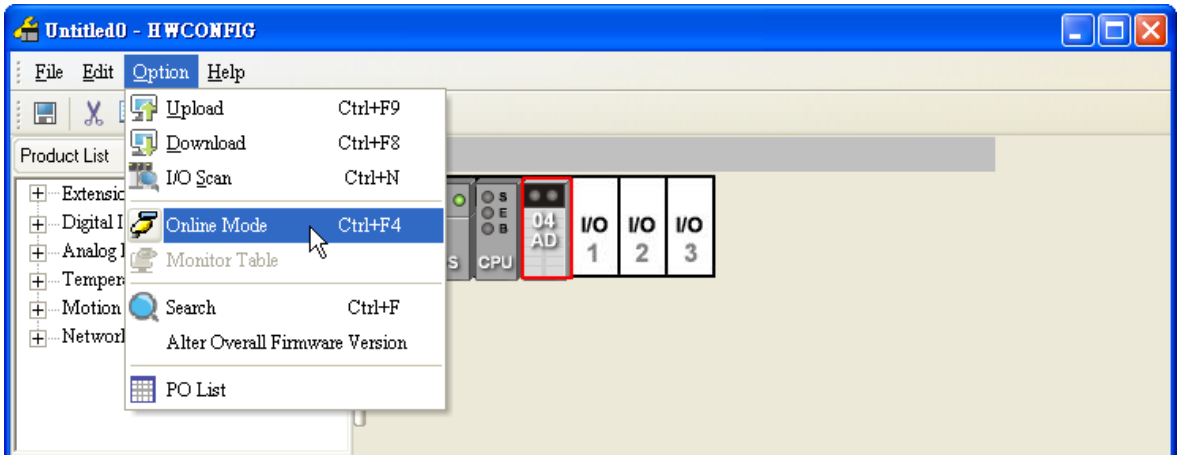


2.4.3 Monitoring Table

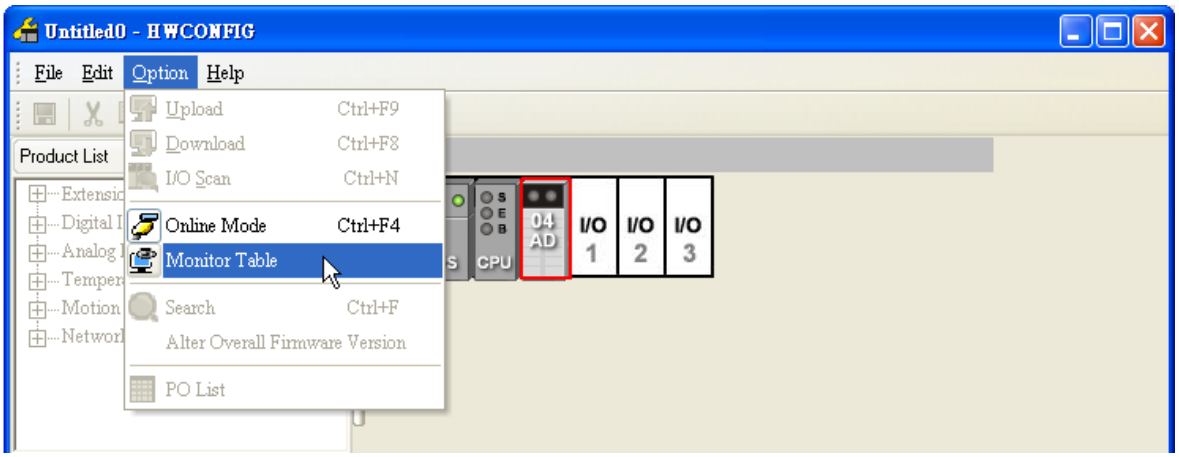
(1) Select the **Monitor** checkboxes at the right sides of the corresponding registers.

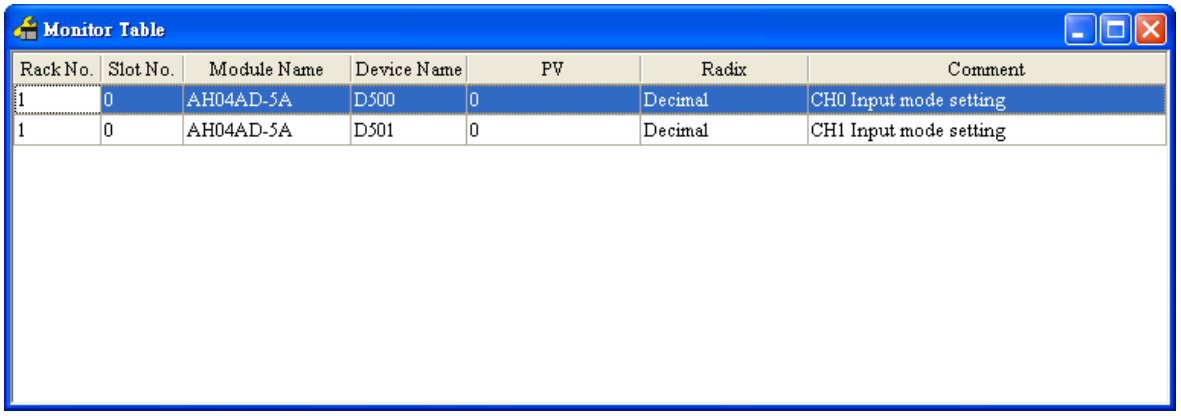


(2) On the **Option** menu, click **Online Mode**.



(3) On the **Option** menu, click **Monitor Table**. The registers are monitored.

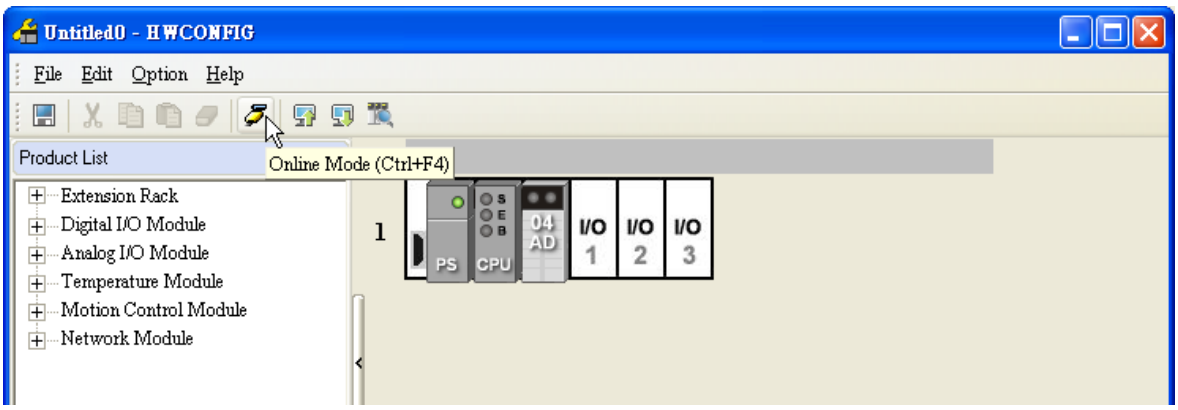




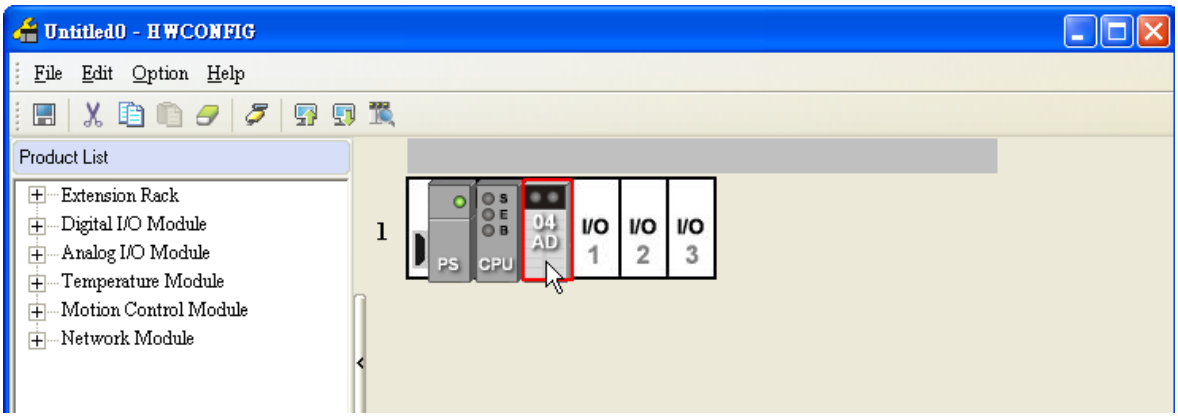
Rack No.	Slot No.	Module Name	Device Name	PV	Radix	Comment
1	0	AH04AD-5A	D500	0	Decimal	CH0 Input mode setting
1	0	AH04AD-5A	D501	0	Decimal	CH1 Input mode setting

2.4.4 Online Mode

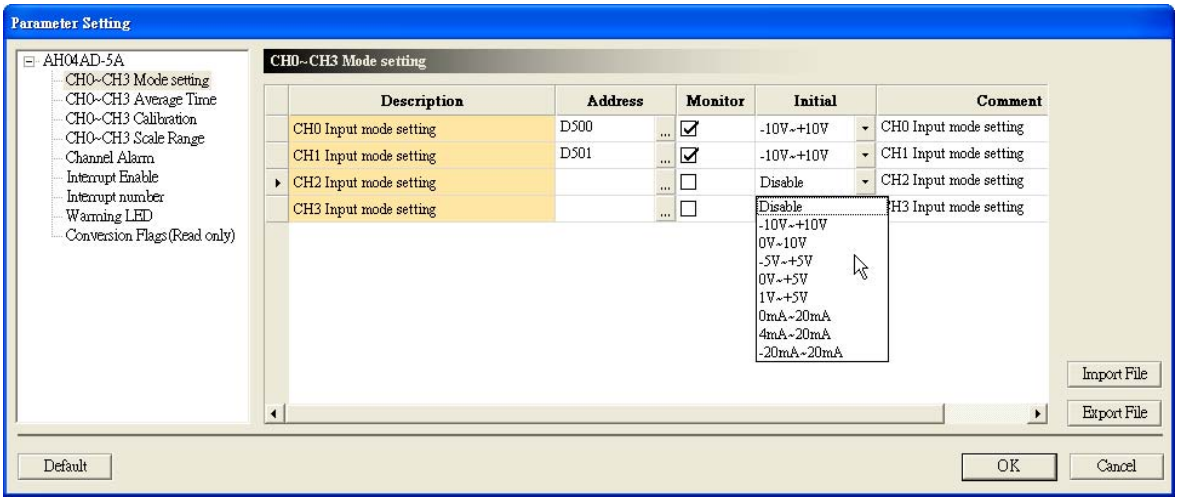
(1) Click **Online Mode** on the toolbar.



(2) Double-click the module.

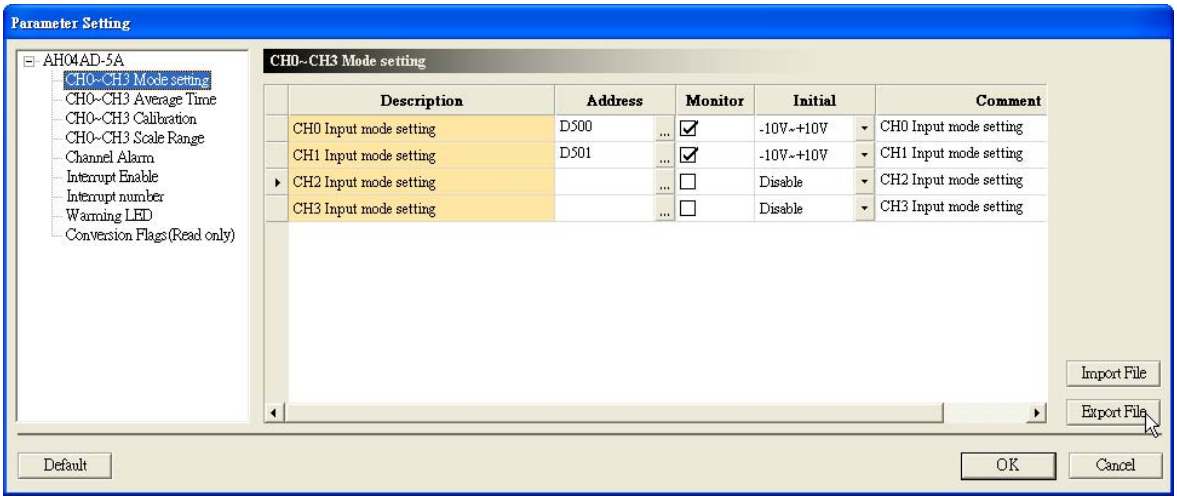


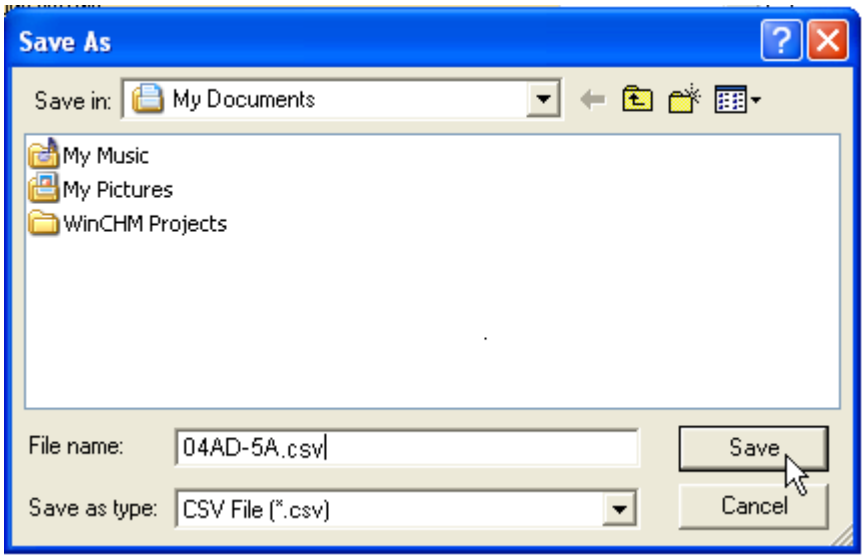
(3) If some parameters are altered, users can click **SV→PV**. The new setting values are written into the CPU module and the I/O module. If users want to read the present values in the I/O module, they can click **Update**. The present values in the I/O module are sent to ISPSoft, and are monitored.



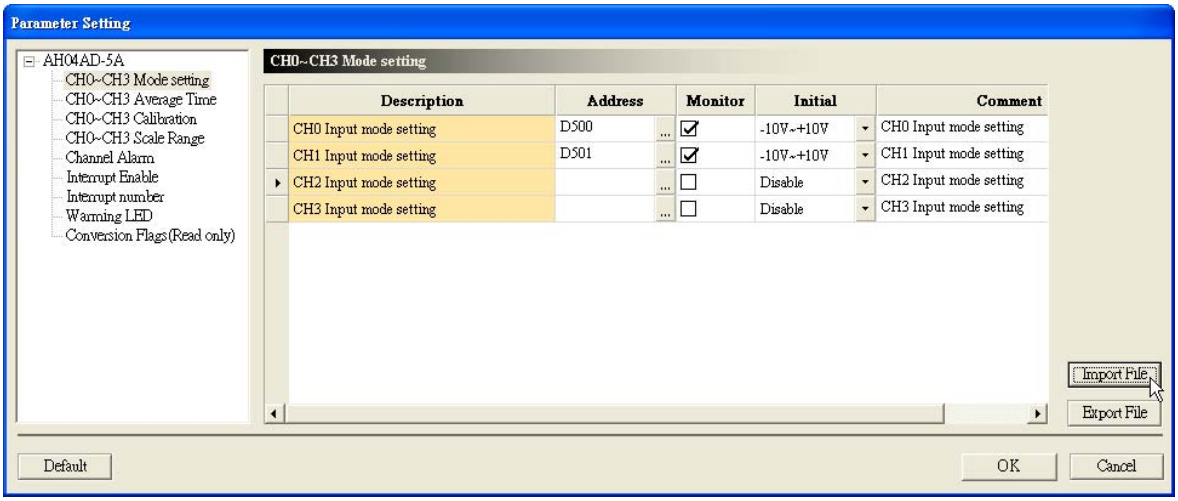
2.4.5 Importing/Exporting a Parameter File

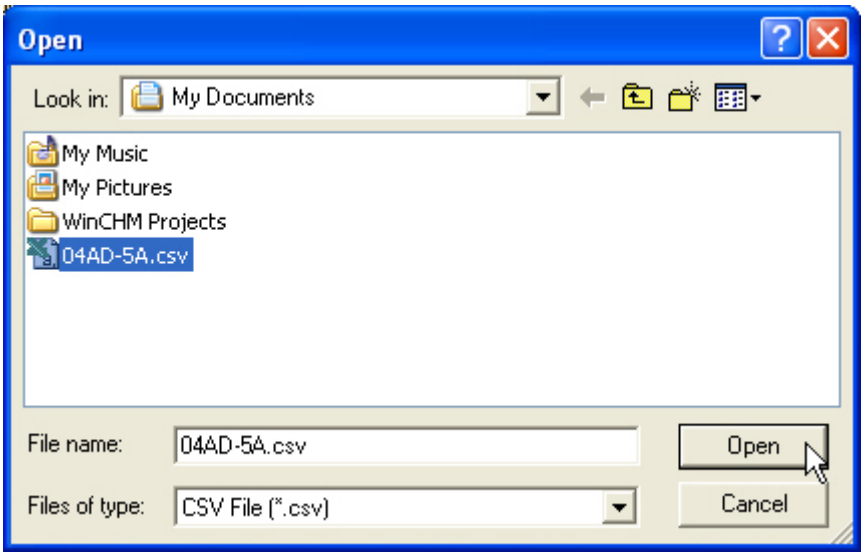
(1) After **Export** is clicked, the parameters will be saved as a CSV file (.csv).



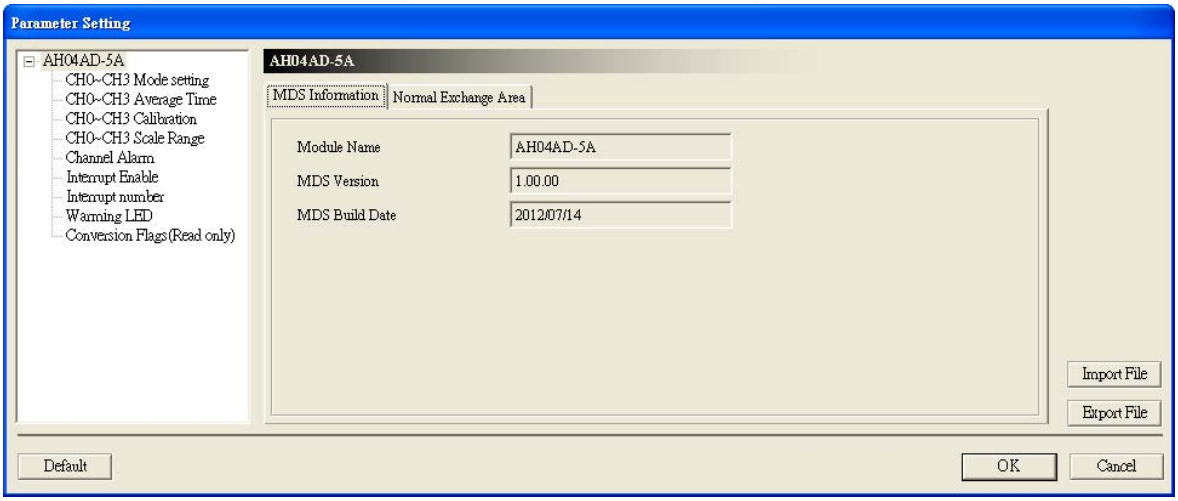


(2) Click **Import**, and then click the CSV file.

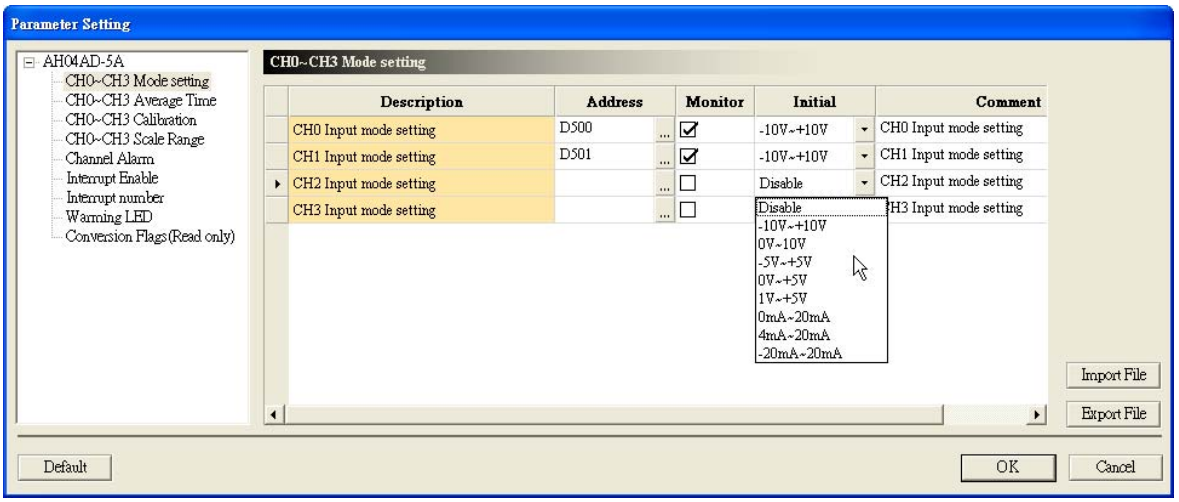




2.4.6 Parameters

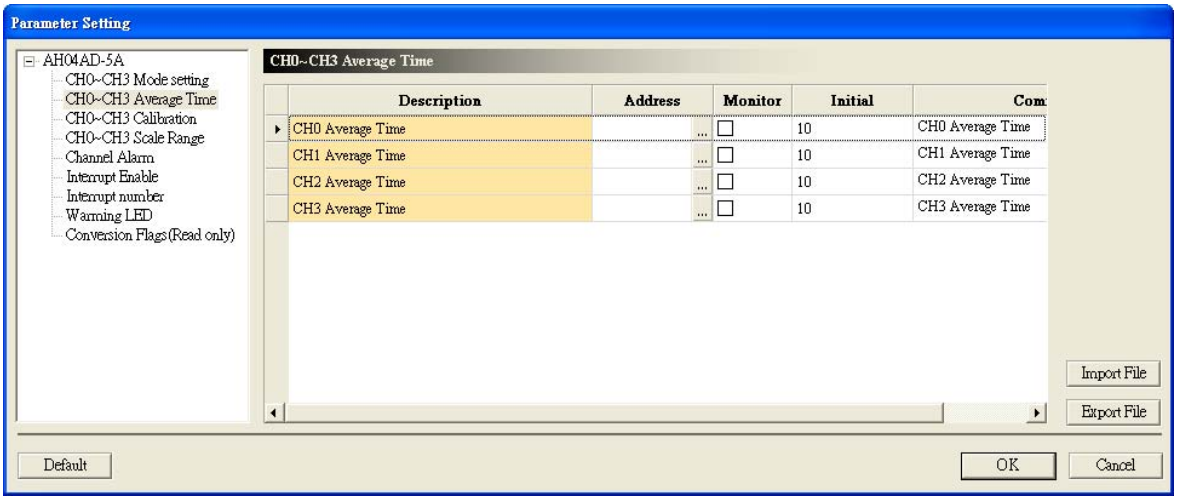


(1) The input modes of the channels

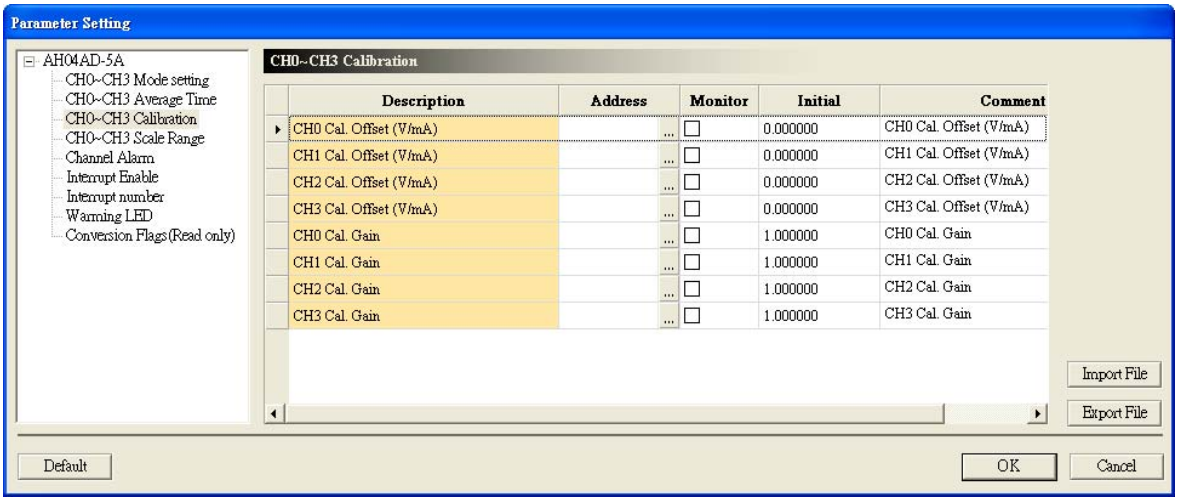


Module name	AH04AD-5A	AH08AD-5B
Description	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V 6: 0 mA ~20 mA 7: 4 mA~20 mA 8: -20 mA~20 mA	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V

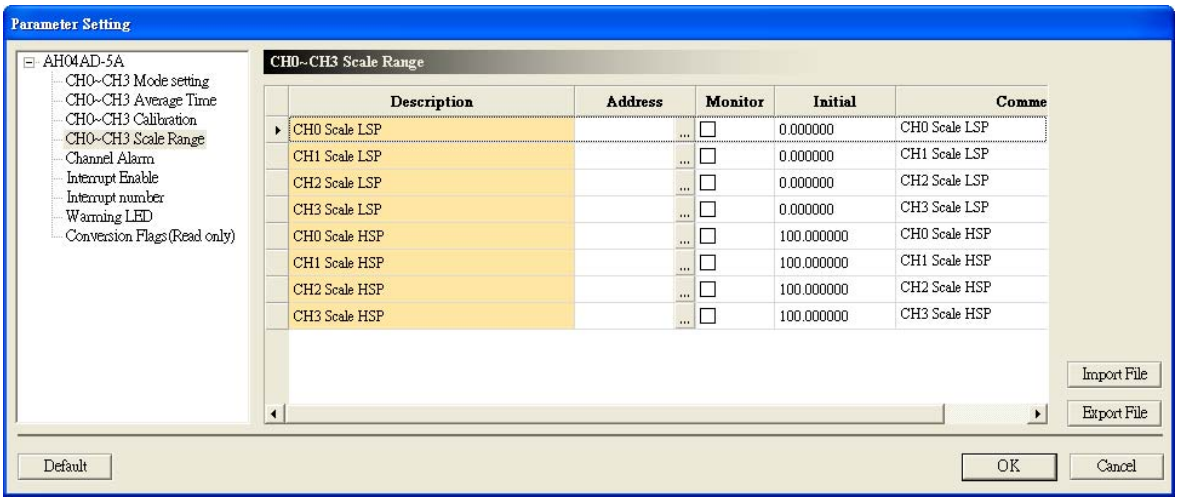
(2) The number of values averaged



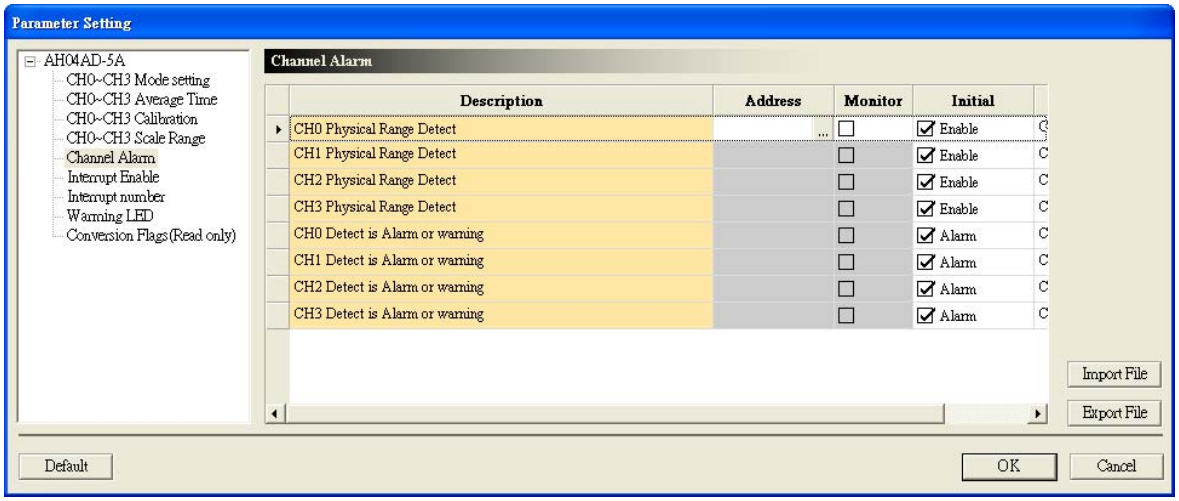
(3) The offsets and the gains used for calibration



(4) The scale range

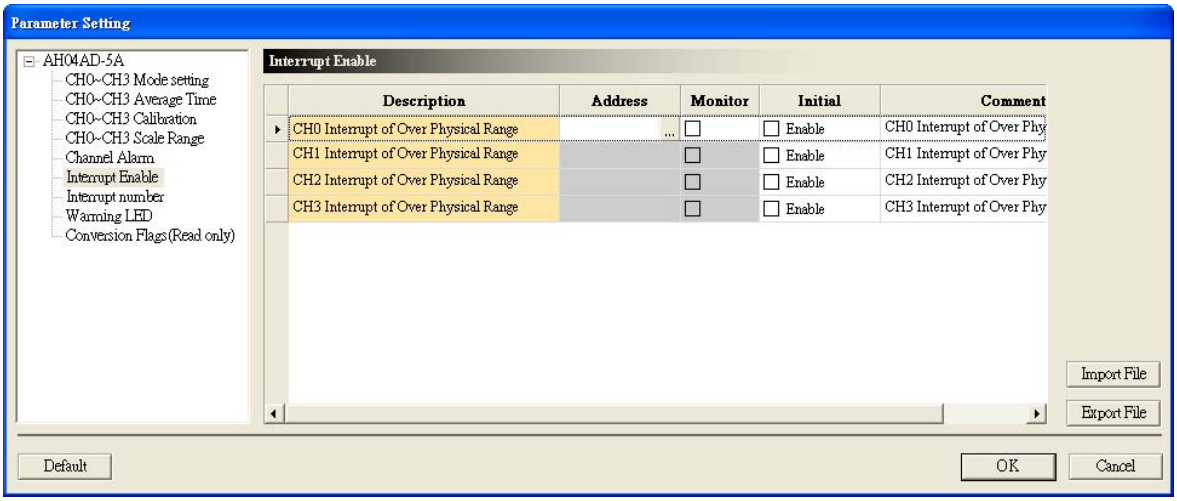


(5) The channel alarm



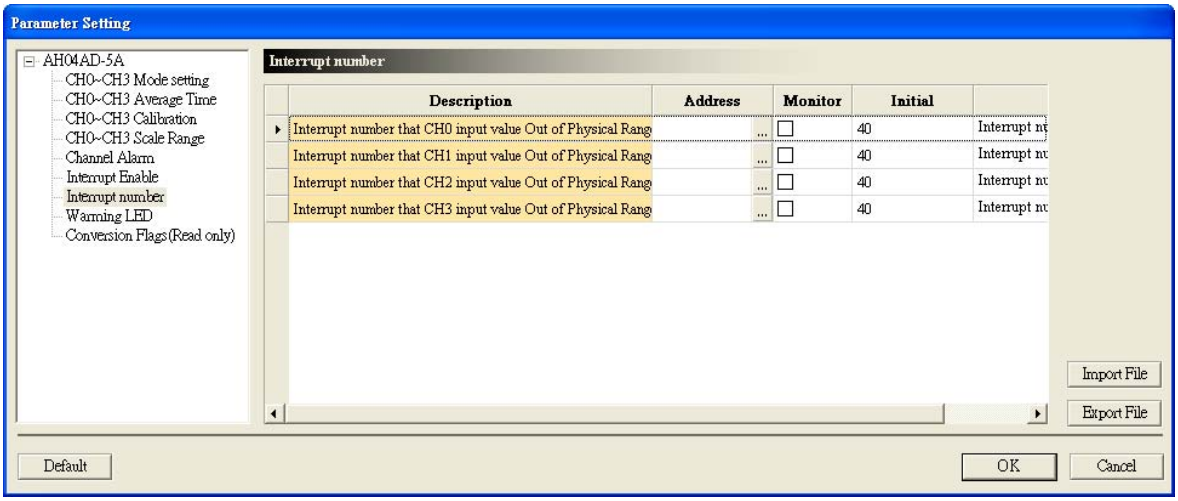
Description	bit0~bit7: CH0~CH7 (The physical range detection) (ON: Enable; OFF: Disable) bit8~bit15: CH0~CH7 (Giving an alarm or a warning) (ON: Alarm; OFF: Warning)

(6) Enabling the interrupts

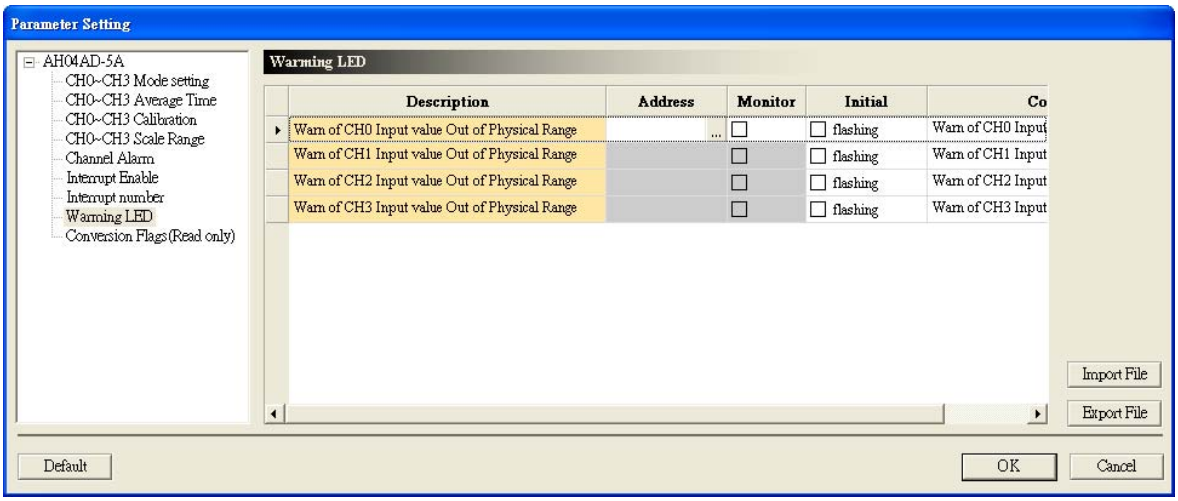


Description	bit0~bit7: CH0~CH7 (The interrupt service routines) (ON: Enable; OFF: Disable)

(7) The interrupt numbers

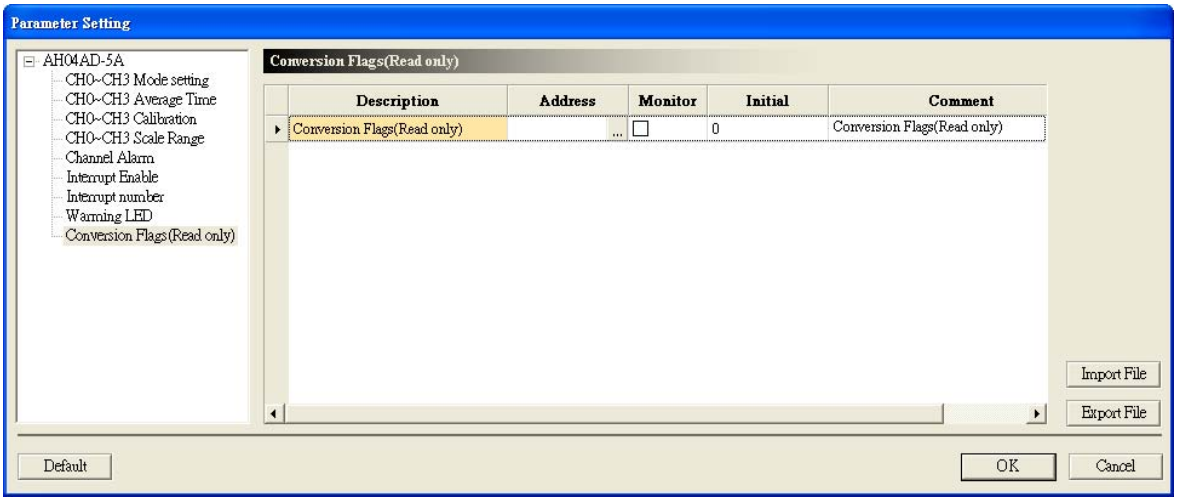


(8) Setting the warning LED indicator



Description	bit0~bit7: CH0~CH7 (Warning LED indicator) (ON: Flash; OFF: Not flash)

(9) The conversion flags



Description	bit0~bit7: The signals received by CH0~CH7 exceed the range of inputs which can be received by the hardware. bit15: The external voltage is abnormal.

2.5 Troubleshooting

2.5.1 Error Codes

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A600	Alarm	Hardware failure	OFF	ON
16#A601	Alarm	The external voltage is abnormal.	OFF	ON
16#A603	Alarm	Internal error The factory correction is abnormal.	OFF	ON
16#A400	Alarm	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A401	Alarm	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A402	Alarm	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A403	Alarm	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A404	Alarm	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A405	Alarm	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A406	Alarm	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A407	Alarm	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A000	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A001	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A002	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A003	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A004	Warning	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A005	Warning	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A006	Warning	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A007	Warning	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A800	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A801	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A802	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A803	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A804	Warning	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	ON	OFF

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A805	Warning	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A806	Warning	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A807	Warning	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	ON	OFF

2.5.2 Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.
The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.
Internal error The factory correction is abnormal.	Please contact the factory.
The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 0.
The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 4.
The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 5.
The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 6.
The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 7.

Chapter 3 Analog Output Module AH04DA-5A/AH08DA-5B/AH08DA-5C

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3.1 Overview

An analog output module receives four/eight pieces of 16-bit digital data from a CPU module. The digital data is converted into analog signals (voltages or currents). The analog signals are sent by the four/eight channels on the analog output module.

3.1.1 Characteristics

(1) **A module is selected according to practical application.**
AH04DA-5A: There are four channels. Outputs sent by a channel can be either voltages or currents.
AH08DA-5B: There are eight channels. Outputs sent by these channels are voltages.
AH08DA-5C: There are eight channels. Outputs sent by these channels are currents.

(2) **High-speed conversion**
A digital signal is converted into an analog signal at a speed of 150 μs a channel.

(3) **High accuracy**
Conversion accuracy: The error is ±0.05% of an output voltage, and ±0.1% of an output current. (The ambient temperature is 25°C.)

(4) **A scale range can be set by means of software.**
Users can set a scale range in ISPSoft. A scale range is a range of digital values corresponding to a range of analog values.

(5) **A module can be set by means of utility software.**
HWCONFIG is built-in utility software in ISPSoft. Users can set modes and parameters in HWCONFIG to complete hardware configuration without spending time writing a program to set registers corresponding to functions.

3.2 Specifications and Functions

3.2.1 Specifications

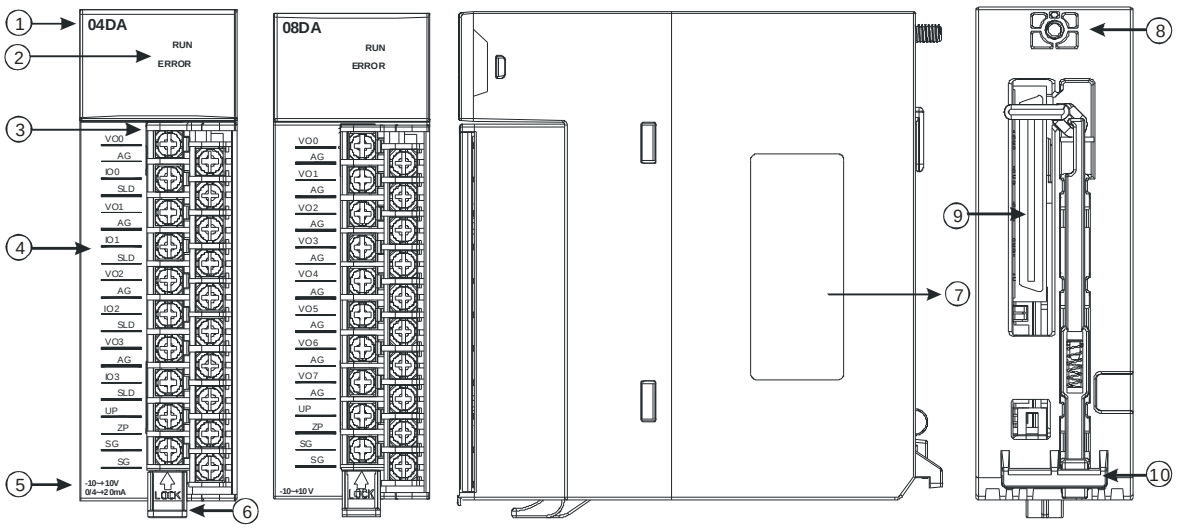
Electrical specifications

Module name	AH04DA-5A	AH08DA-5B	AH08DA-5C
Number of outputs	4	8	8
Analog-to-digital conversion	Voltage output/Current output	Voltage output	Current output
Supply voltage	24 V DC (20.4 V DC~28.8 V DC) (-15%~+20%)		
Connector type	Removable terminal block		
Overall accuracy	25°C (77°F): The error is ±0.05% of an output voltage, and ±0.1% of an output current. -20~60°C (-4~140°F): The error is ±0.1% of an output voltage, and ±0.15% of an output current.		
Conversion time	150 μs/channel		
Isolation	There is isolation between a digital circuit and an analog circuit, but there is no isolation between analog channels. Isolation between a digital circuit and a ground: 500 V DC Isolation between an analog circuit and a ground: 500 V DC Isolation between an analog circuit and a digital circuit: 500 V DC Isolation between the 24 V DC and a ground: 500 V DC		

Functional specifications

Analog-to-digital conversion	Voltage output				
Rated output range	±10 V	0 V~10 V	±5 V	0 V~5 V	1 V~5 V
Hardware output range	-10.1 V~10.1 V	-0.1 V~10.1 V	-5.05 V~5.05 V	-0.05 V~5.05 V	0.95 V~5.05 V
Fiducial error (25°C)	±0.01%	±0.02%	±0.01%	±0.01%	±0.01%
Linearity error	±0.006%	±0.01%	±0.01%	±0.02%	±0.02%
Hardware resolution	16 bits				
Permissible load impedance	1 kΩ~2 MΩ: ±10 V and 0 V~10 V ≧500 Ω: 1 V~5 V				
Analog-to-digital conversion	Current output				
Rated output range	0 mA~20 mA		4 mA~20 mA		
Hardware output range	-0.2 mA~20.2 mA		3.8 mA~20.2 mA		
Fiducial error (25°C)	±0.01%		±0.01%		
Linearity error	±0.01%		±0.01%		
Hardware resolution	16 bits				
Permissible load impedance	≦550 Ω				

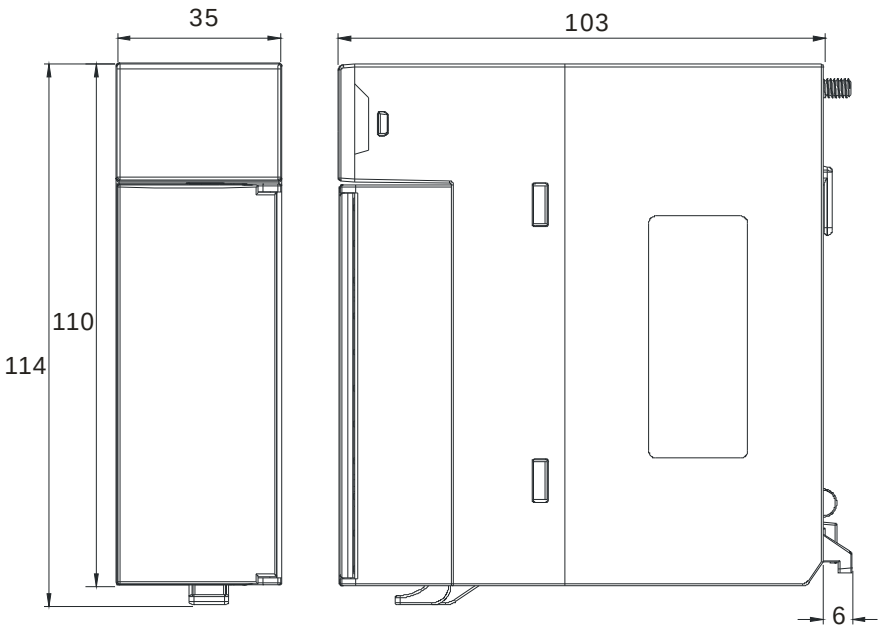
3.2.2 Profile



Number	Name	Description
1	Model name	Model name of the module

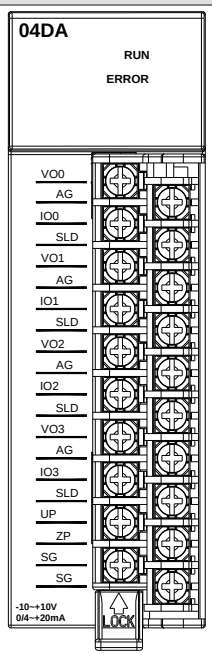
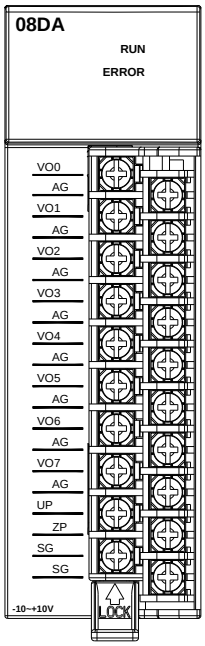
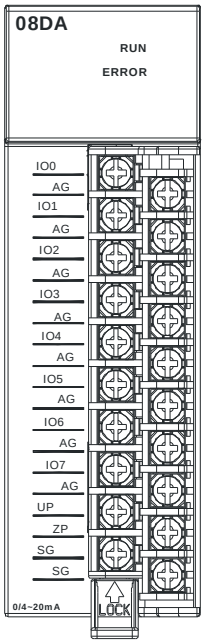
Number	Name	Description
2	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.
3	Removable terminal block	The outputs are connected to loads which will be driven.
4	Arrangement of the output terminals	Arrangement of the terminals
5	Description of the outputs	Simple specifications for the module
6	Clip	Removing the terminal block
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

3.2.3 Dimensions



Unit: mm

3.2.4 Arrangement of Terminals

AH04DA-5A	AH08DA-5B	AH08DA-5C
		

3.2.5 Functions

HWCONFIG, built-in utility software in ISPSoft, can be used to set a module. Users can set modes and parameters by means of HWCONFIG.

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Calibration	Users can calibrate an analog output curve.
3	Scale range	A digital range corresponds to an analog range.
4	Retaining an output	When a module stops running, a signal sent by the module is retained.

1. Enabling/Disabling a channel

A digital signal is converted into an analog signal at a speed of 150 μs a channel. The total conversion time is 150 μs×(the number of channels). If a channel is not used, users can disable it to decrease the total conversion time.

2. Calibration

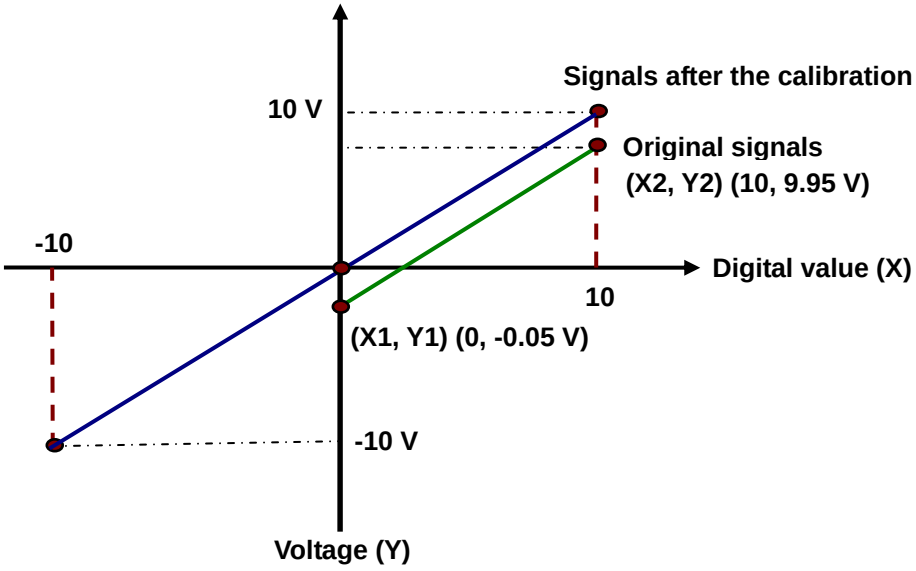
- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of outputs which can be sent by hardware.
- A volt is a unit of calibration for offsets if outputs sent are voltages. A milliampere is a unit of calibration for offsets if outputs sent are currents.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

Example 1:

The outputs sent by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. The digital value received by the channel is 0, and the voltage measured is -0.05 V. The digital value received by the channel is 10, and the voltage measured is 9.95 V. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[9.95-(-0.05)]/(10-0)=1
Gain used for calibration=1/Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1= -0.05
Offset used for calibration=0-Y1=0.05



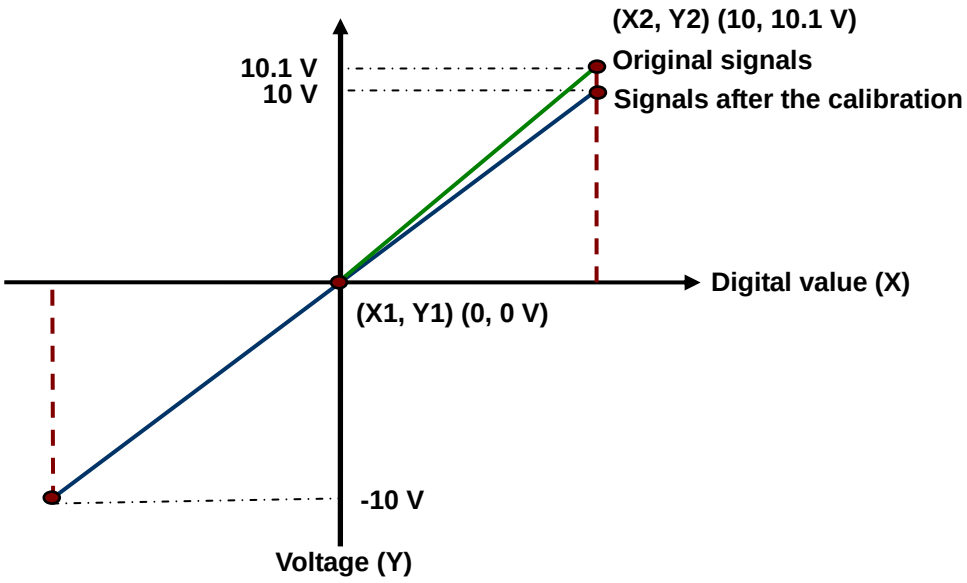
(X: Digital value; Y: Analog signal)

Example 2:

The outputs sent by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. The digital value received by the channel is 0, and the voltage measured is 0 V. The digital value received by the channel is 10, and the voltage measured is 10.1 V. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[10.1-0]/(10-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

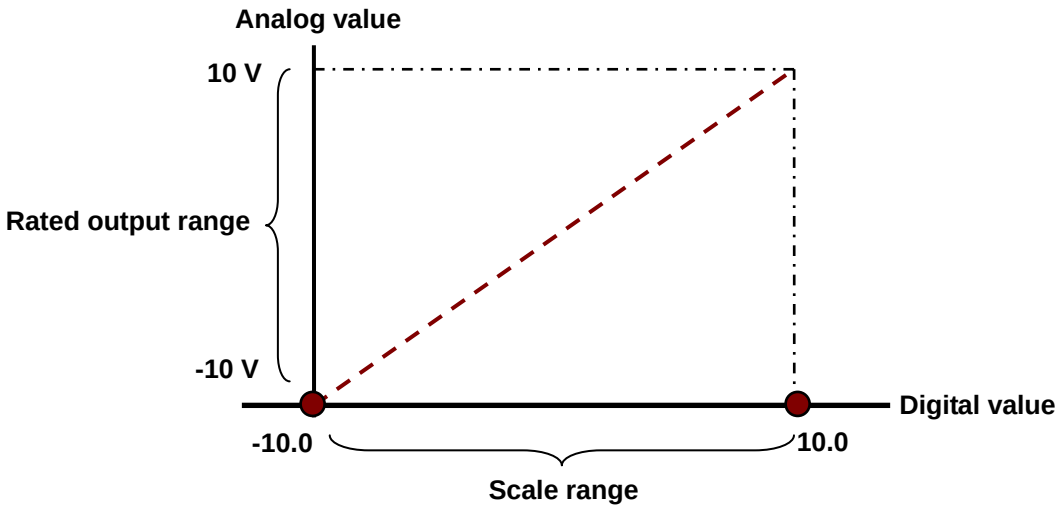
The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



(X: Digital value; Y: Analog signal)

3. Scale range

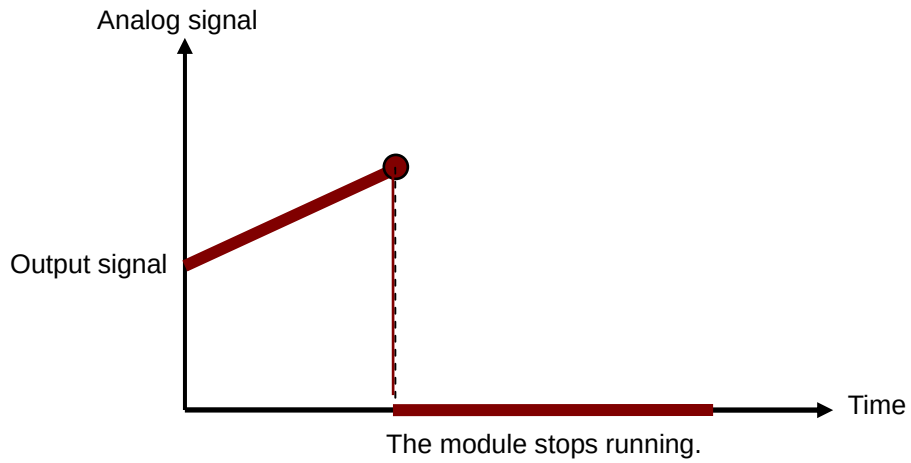
The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by a module. For example, if the analog range is -10 V~10 V and the digital range is -10.0~10.0, the digital values -10.0~10.0 correspond to the analog values -10 V~10 V.



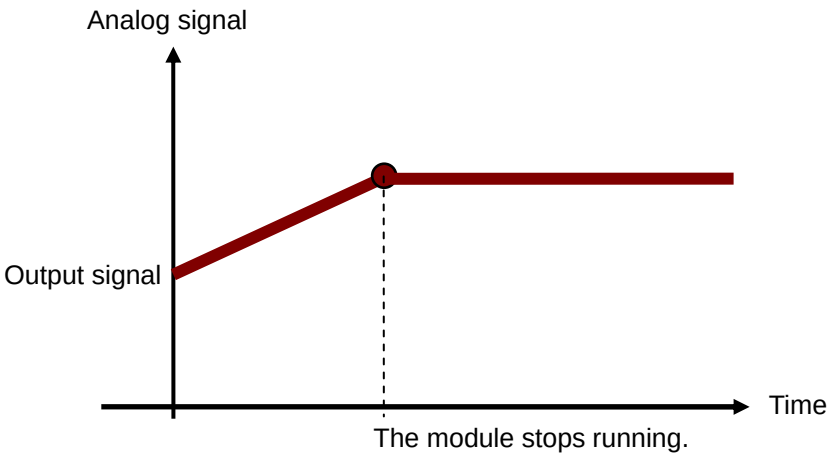
4. Retaining an output

When a module stops running, a signal sent by the module is retained.

The output is not retained:



The output is retained:

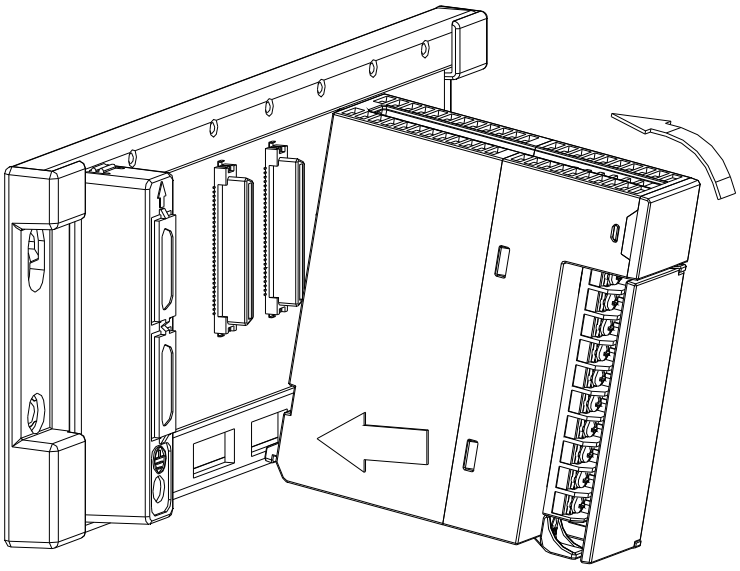


3.3 Installation

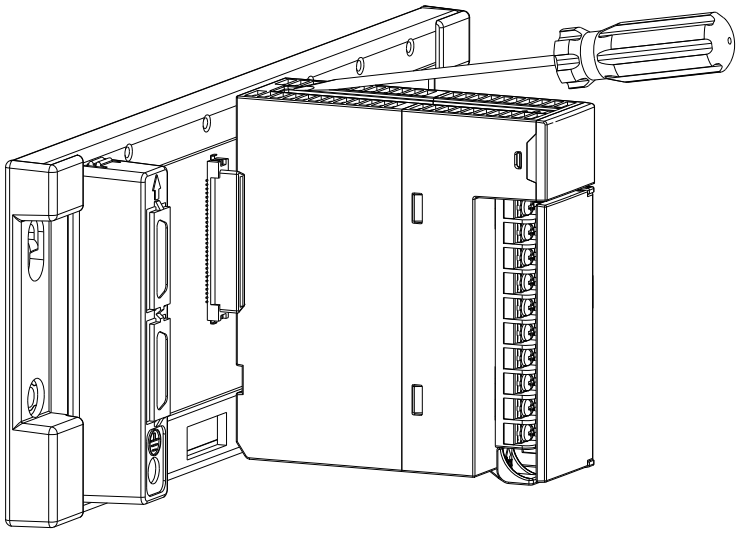
3.3.1 Installing a Module

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.

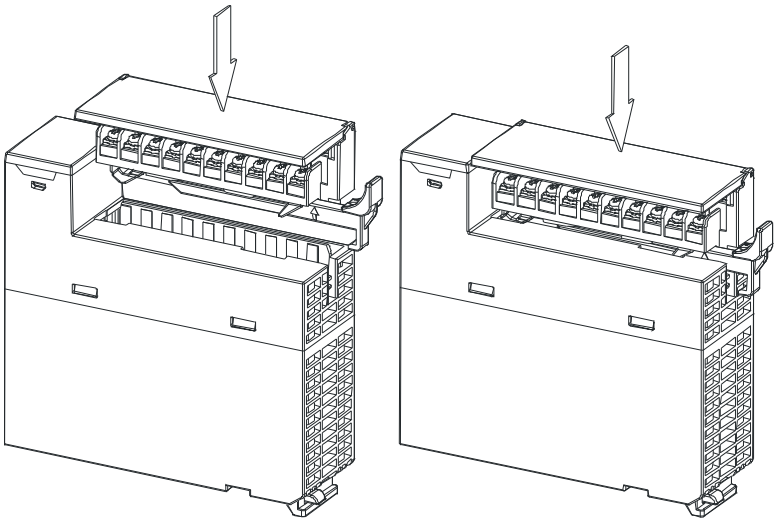


3. Tighten the screw on the module.

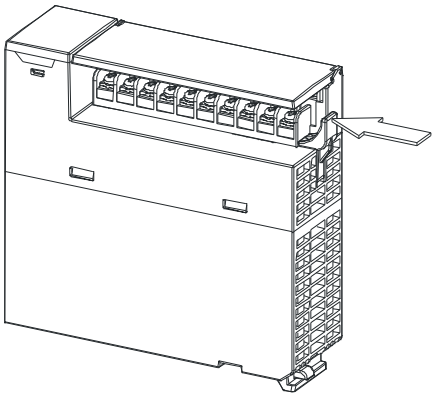


3.3.2 Installing a Removable Terminal Block

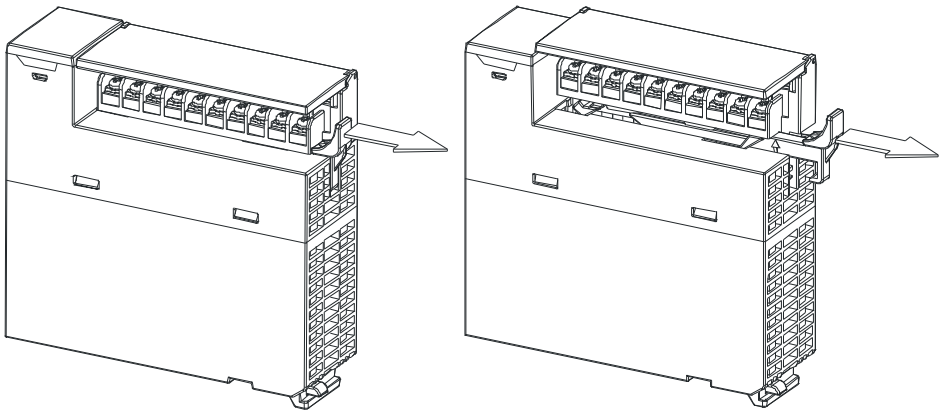
- **Installation**
  1. Level a terminal block at the printed circuit board, and press it into the module.



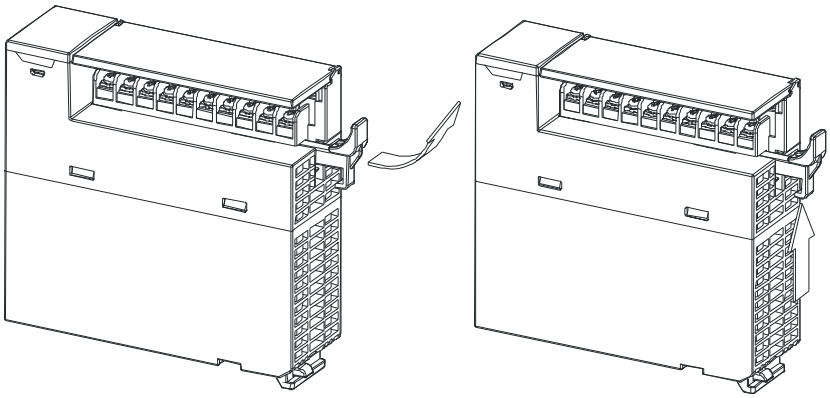
  2. Press the clip in the direction indicated by the arrow.



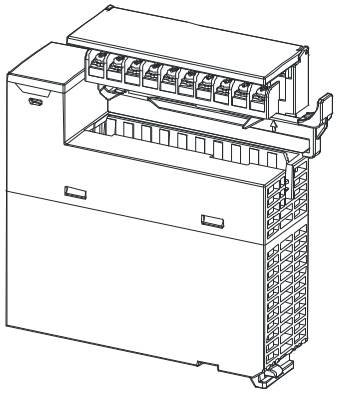
- **Removal**
  1. Pull the clip in the direction indicated by the arrow.



2. Pull up the clip.



3. The terminal block is removed.



3.3.3 Wiring

- **Precautions**

  In order to make the functions of a digital-to-analog module perfect and ensure the reliability of a system at the same time, external wiring which prevents noise is necessary. Before installing cables, users need to follow the precautions below.

  (1) To prevent a surge and induction, an AC cable and the output signal cables which are connected to AH04DA-5A/AH08DA-5B must be separate cables.

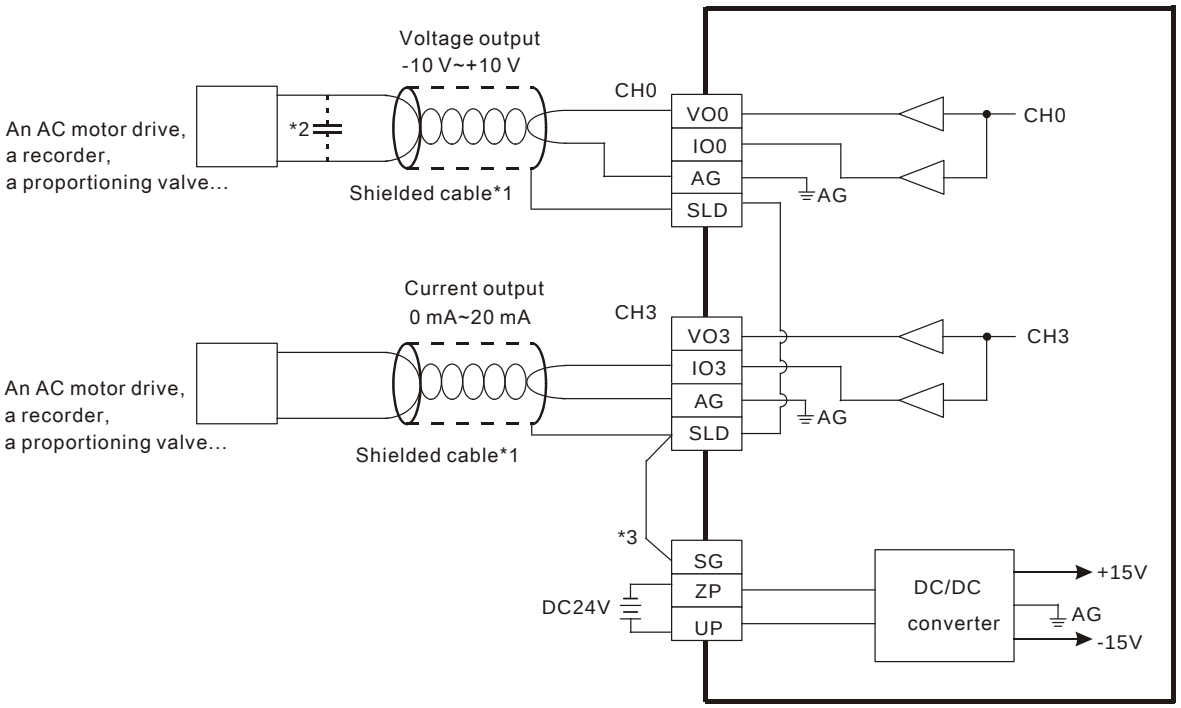
  (2) A cable must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Besides, a cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Otherwise, effects that noise, induction, and a surge have will increase.

  (3) Please connect a shielded cable and a hermetically sealed cable with the ground separately.

  (4) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.

- **External wiring**

  (1) AH04DA-5A

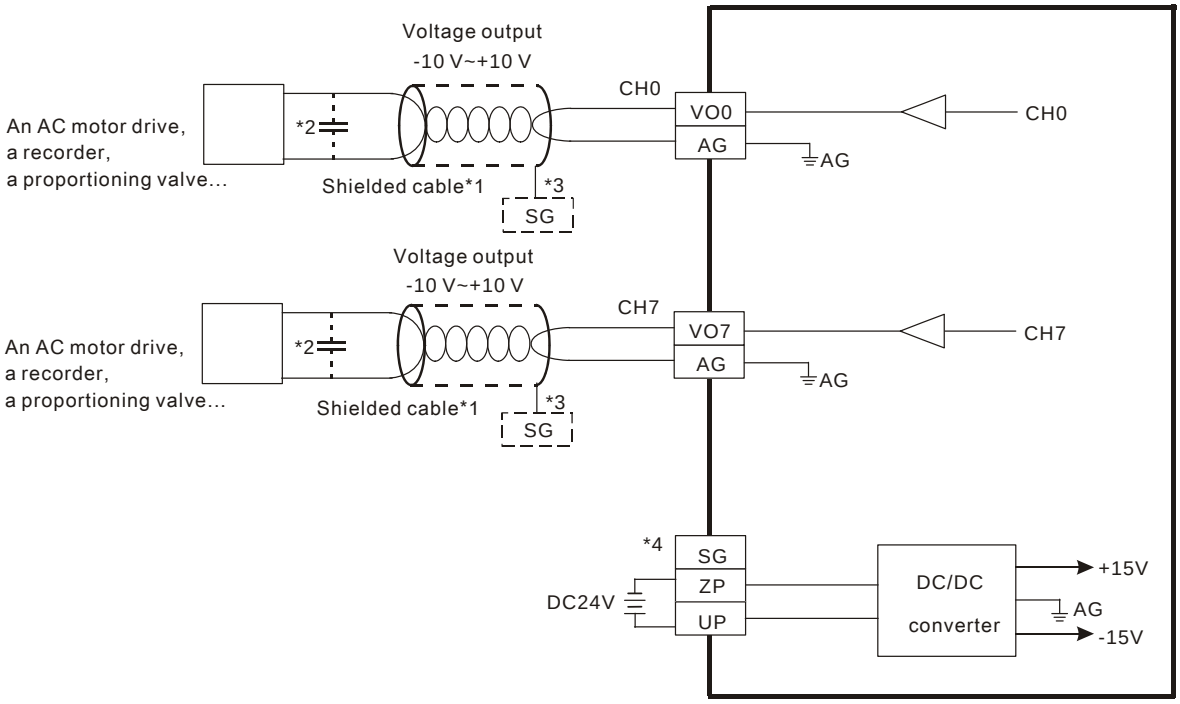


*1. Please isolate the analog output signal cables from other power cables.

*2. If the ripple is large for the input terminal of the load and results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*3. Please connect the terminal SLD to the terminal SG. Once AH04DA-5A is installed on a backplane, the terminal SG on AH04DA-5A and the terminal ⏚ on the backplane will be short-circuited. Please connect the terminal ⏚ on the backplane to the ground terminal ⏚.

(2) AH08DA-5B



*1. Please isolate the analog output signal cables from other power cables.

*2. If the ripple is large for the input terminal of the load and results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*3. Please connect the shielded cables to the terminal SG.

*4. Once AH08DA-5B is installed on a backplane, the terminal SG on AH08DA-5B and the terminal ⏚ on the backplane will be short-circuited. Please connect the terminal ⏚ on the backplane to the ground terminal ⏚.

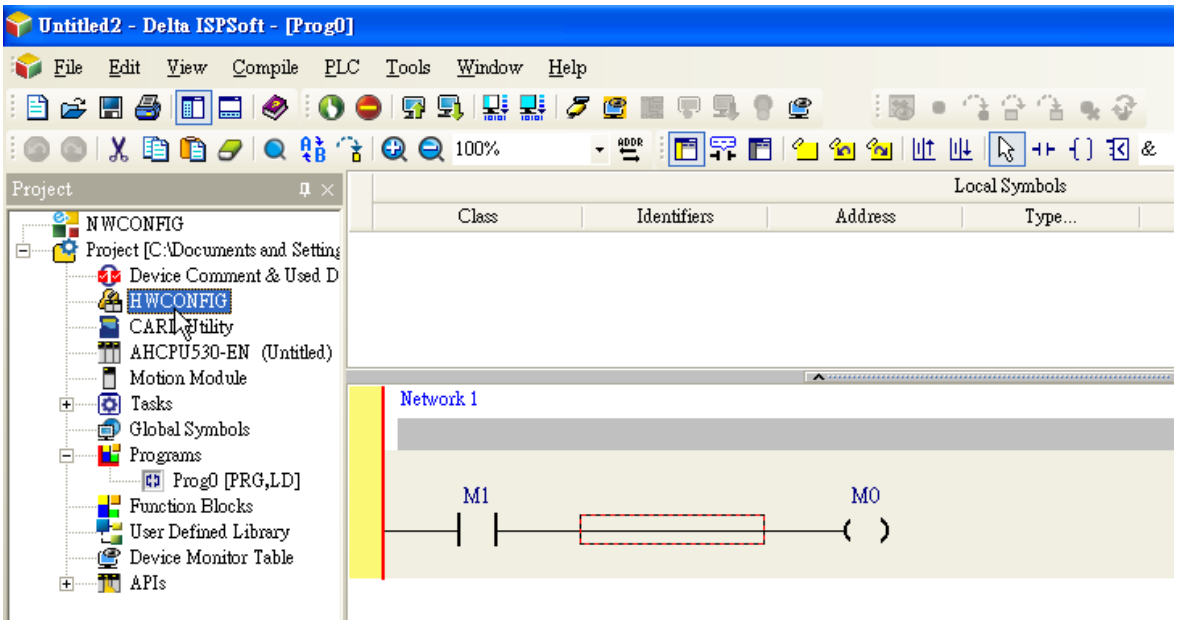
3.3.4 LED Indicators

Number	Name	Description
1	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
2	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.

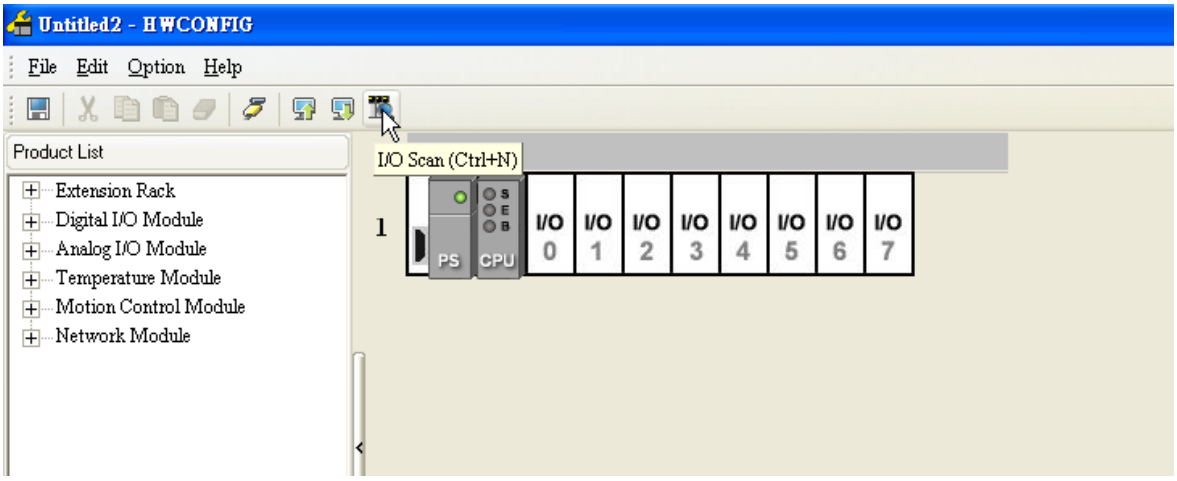
3.4 HWCONFIG in ISPSoft

3.4.1 Initial Setting

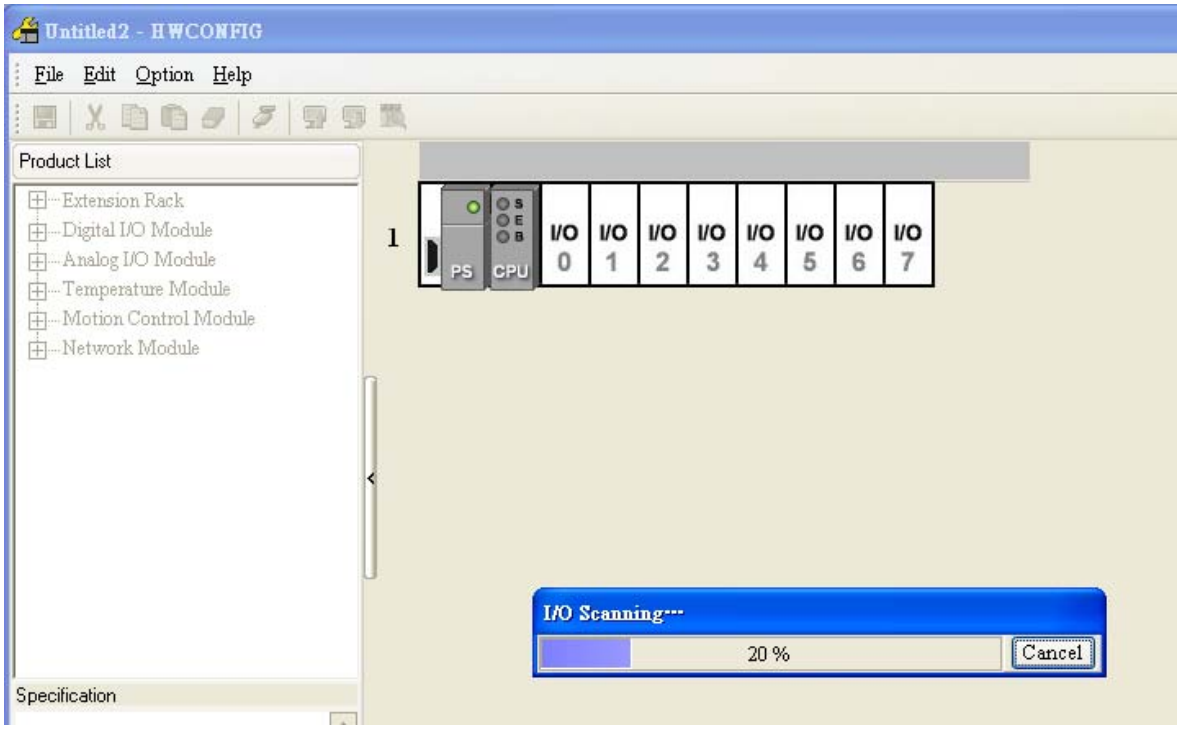
(1) Start ISPSoft, and then double-click **HWCONFIG**.



(2) Click **I/O scan** on the toolbar.



(3) ISPSoft is scanning the actual hardware configuration.



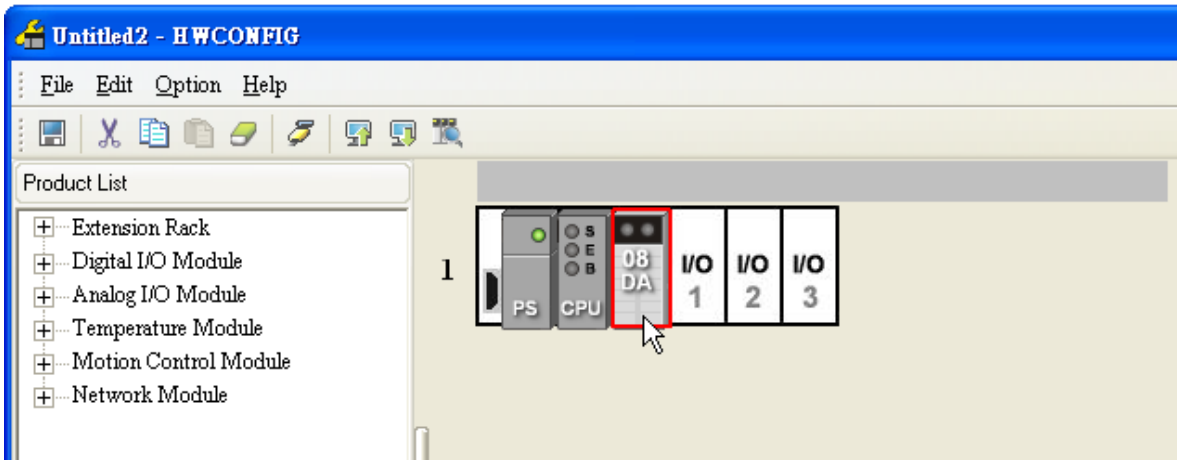
(4) After the scan of the actual hardware configuration is complete, the system automatically assigns the corresponding registers to the channels. Users can alter the output device range by themselves.

Note: Owing to the fact that values are floating-point numbers, every channel occupies two 16-bit registers.

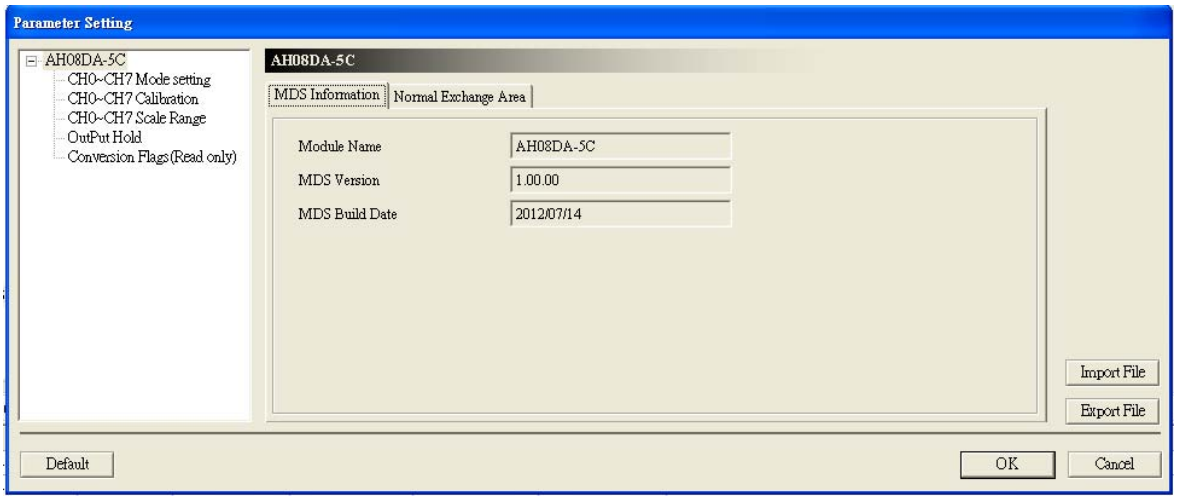
Information: Rack 1

Slot No.	Label	Firmware Versi...	Description	Input Device Ra...	Output Device R...	Comment
-	AHPS05-5A	-	AH Power Supply	None	None	
-	AHCPU530-EI	1.00	Basic CPU module	None	None	
0	AH08DA-5C	1.00	8 x AO 16 bit		D0 ~ D15	

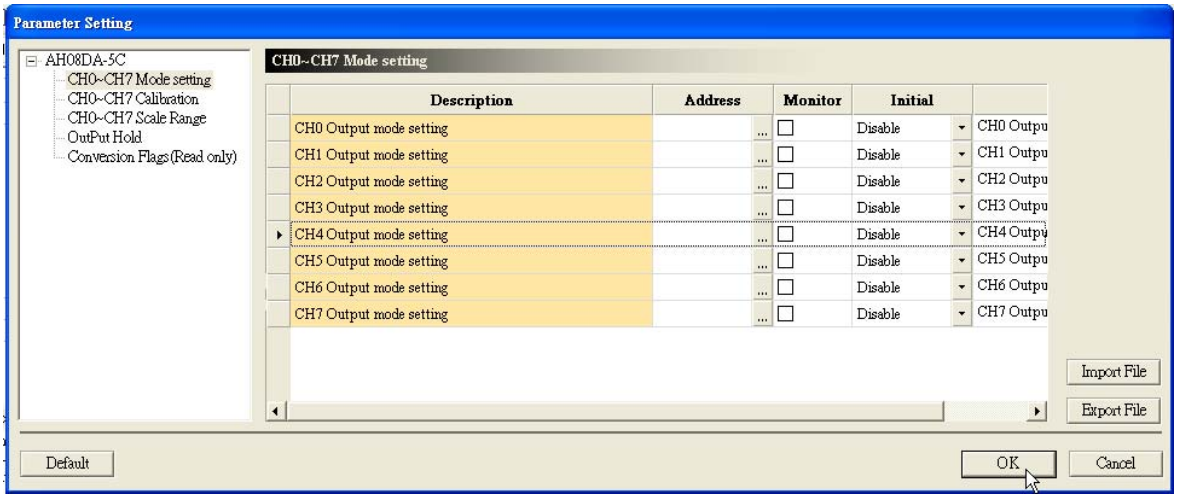
(5) Double-click the module.



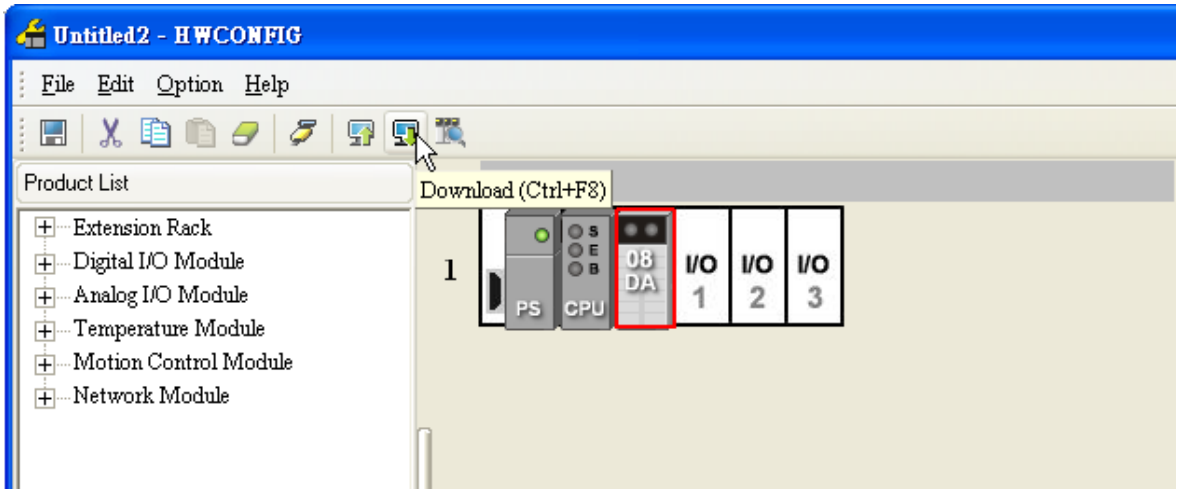
(6) Open the **Parameter Setting** window.



(7) Set the parameters, and then click **OK**.

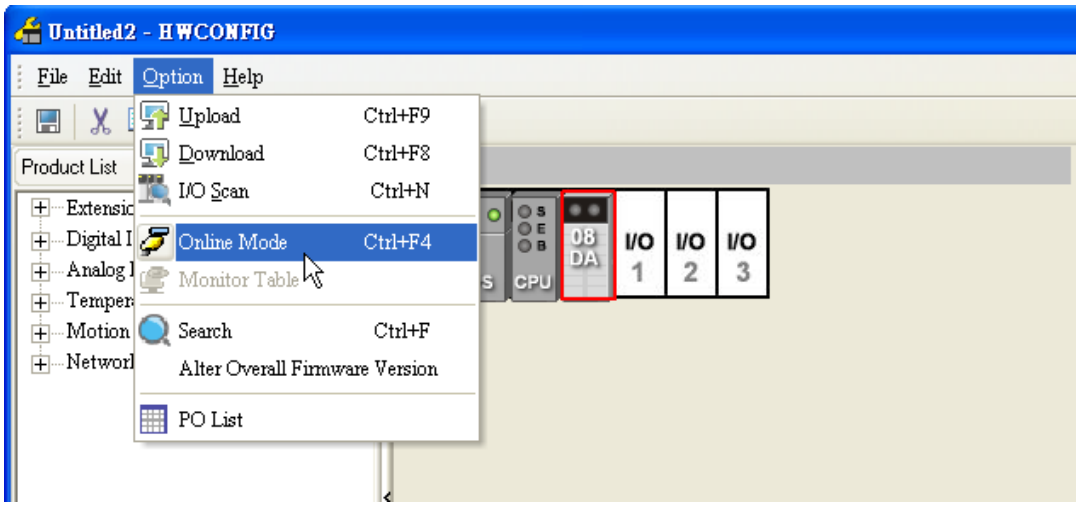


(8) Click **Download** on the toolbar to download the parameters. (The parameters can not be downloaded when the CPU module runs.)

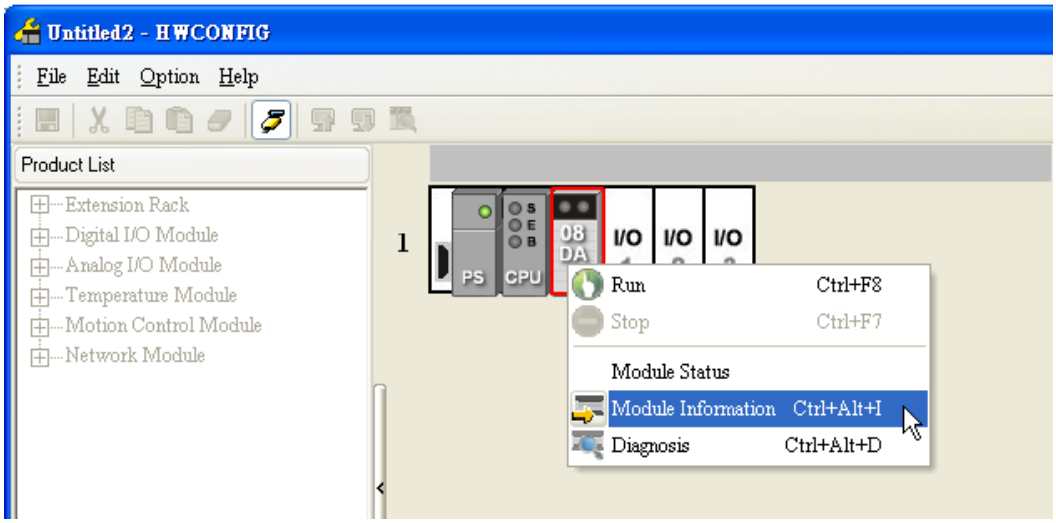


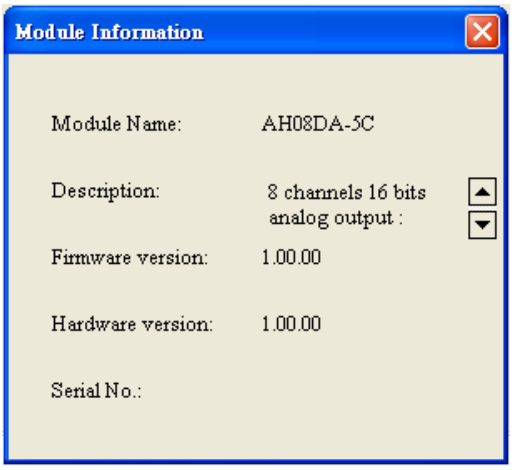
3.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



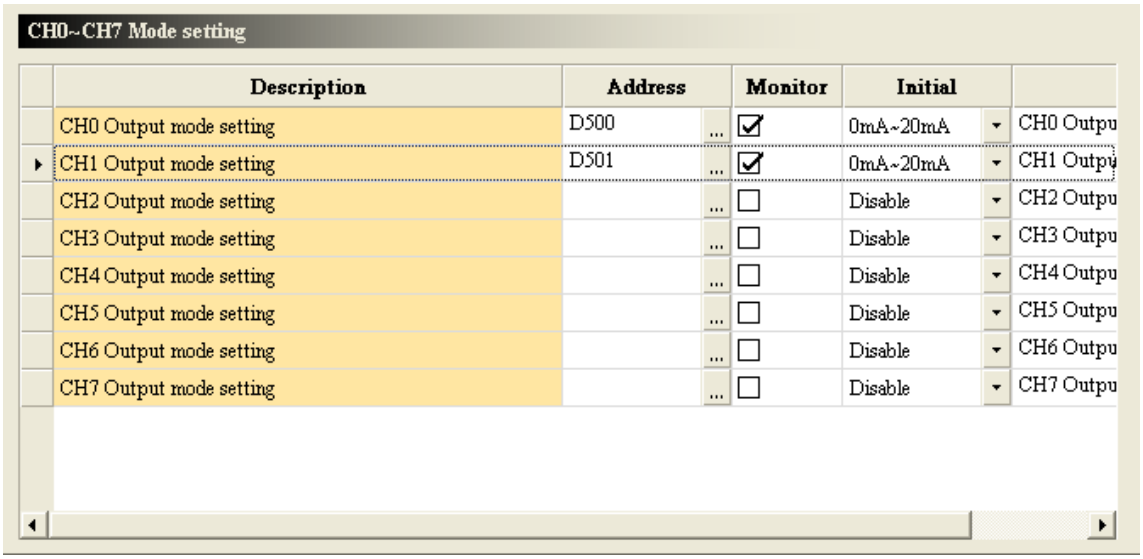
(2) Right-click the module, and then click **Module Information** on the context menu. The version of the firmware and that of the hardware are displayed.



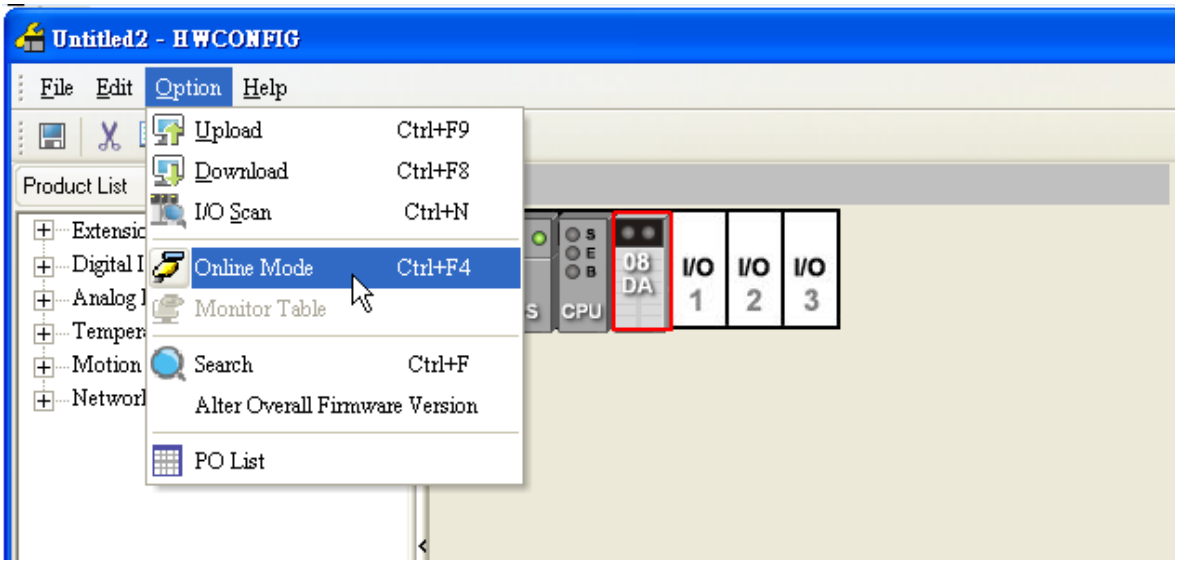


3.4.3 Monitoring Table

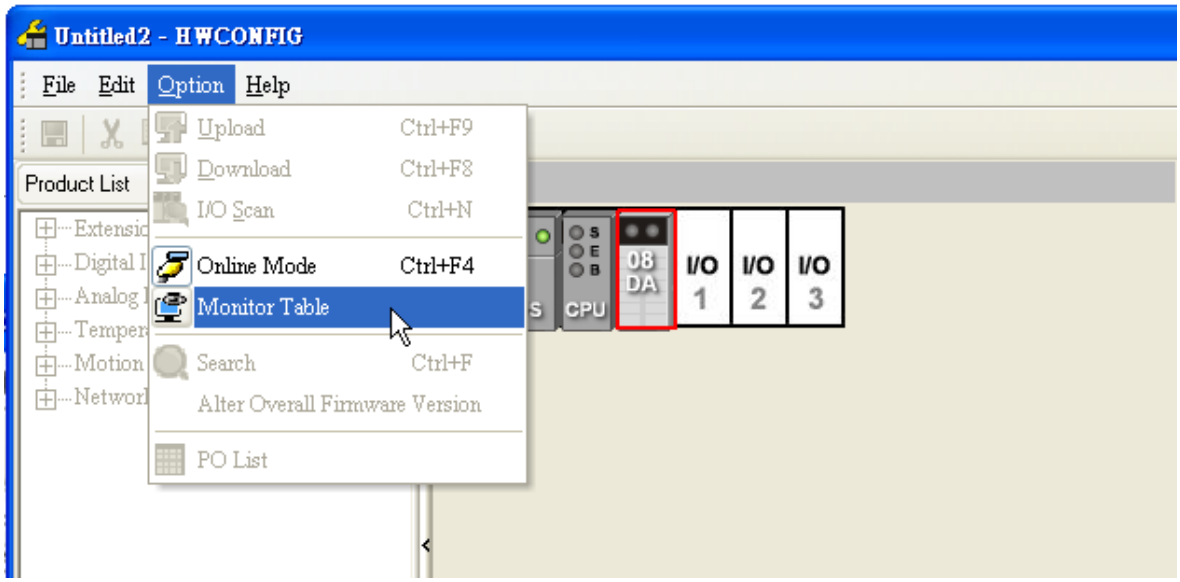
(1) Select the **Monitor** checkboxes at the right sides of the corresponding registers.

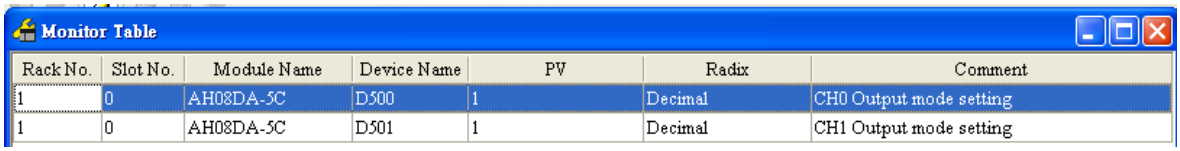


(2) On the **Option** menu, click **Online Mode**.



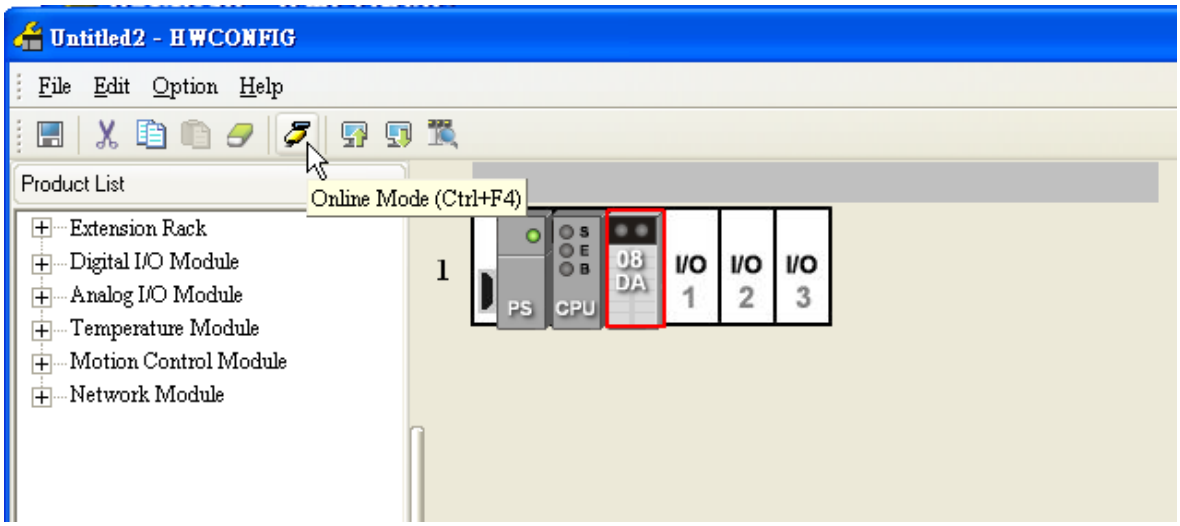
(3) On the **Option** menu, click **Monitor Table**. The registers are monitored.



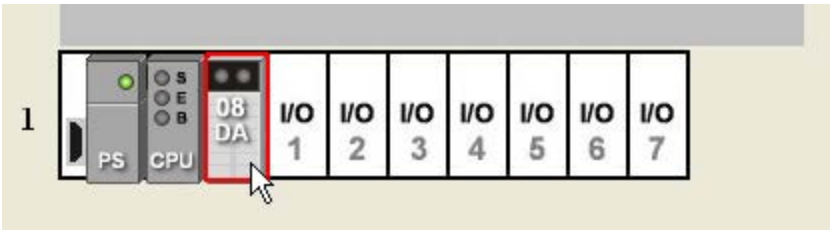

Monitor Table
Rack No. | Slot No. | Module Name | Device Name | PV | Radix | Comment
1 | 0 | AH08DA-5C | D500 | 1 | Decimal | CH0 Output mode setting
1 | 0 | AH08DA-5C | D501 | 1 | Decimal | CH1 Output mode setting

3.4.4 Online Mode

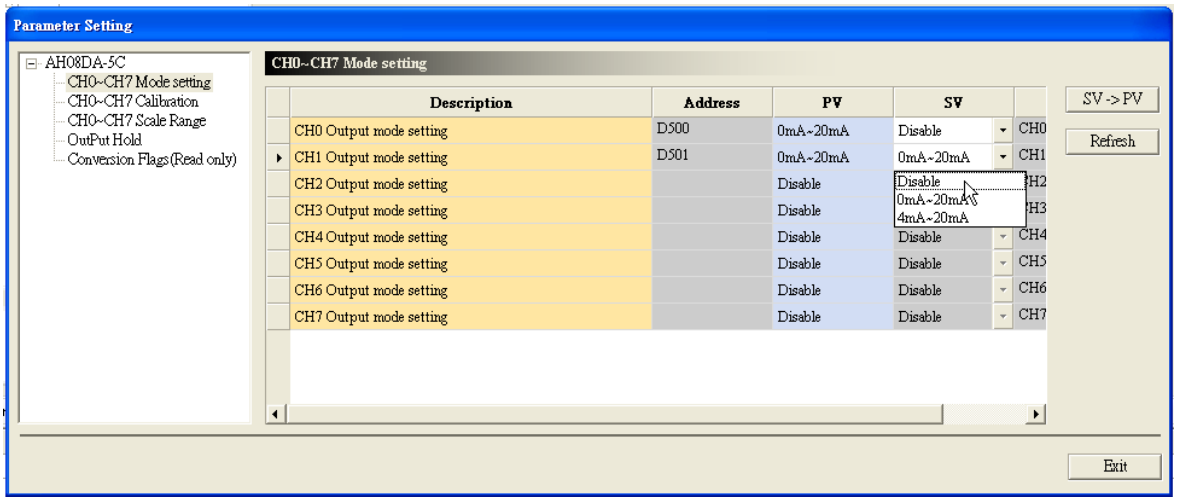
(1) Click **Online Mode** on the toolbar.



(2) Double-click the module.

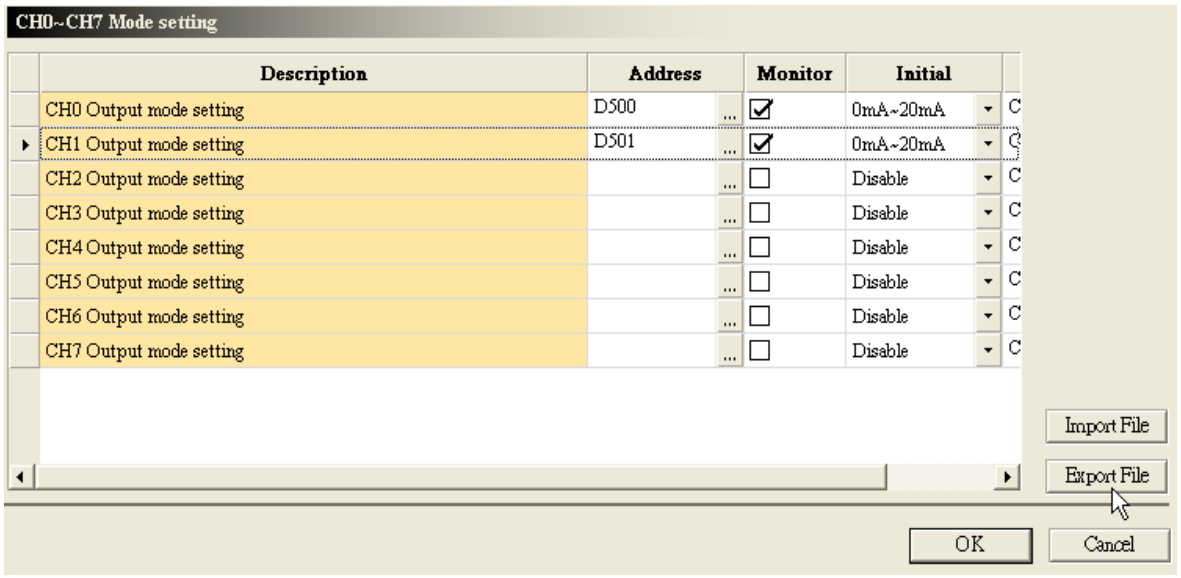


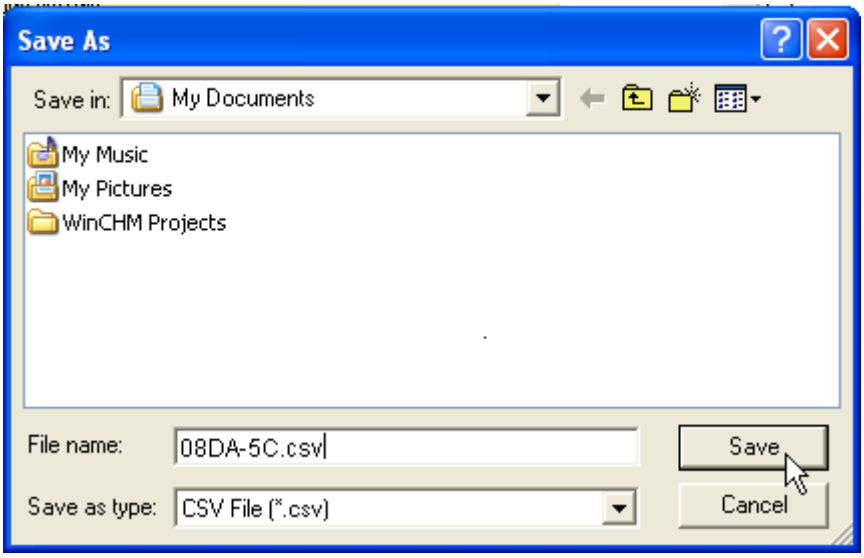
(3) If some parameters are altered, users can click **SV→PV**. The new setting values are written into the CPU module and the I/O module. If users want to read the present values in the I/O module, they can click **Update**. The present values in the I/O module are sent to ISPSoft, and are monitored.



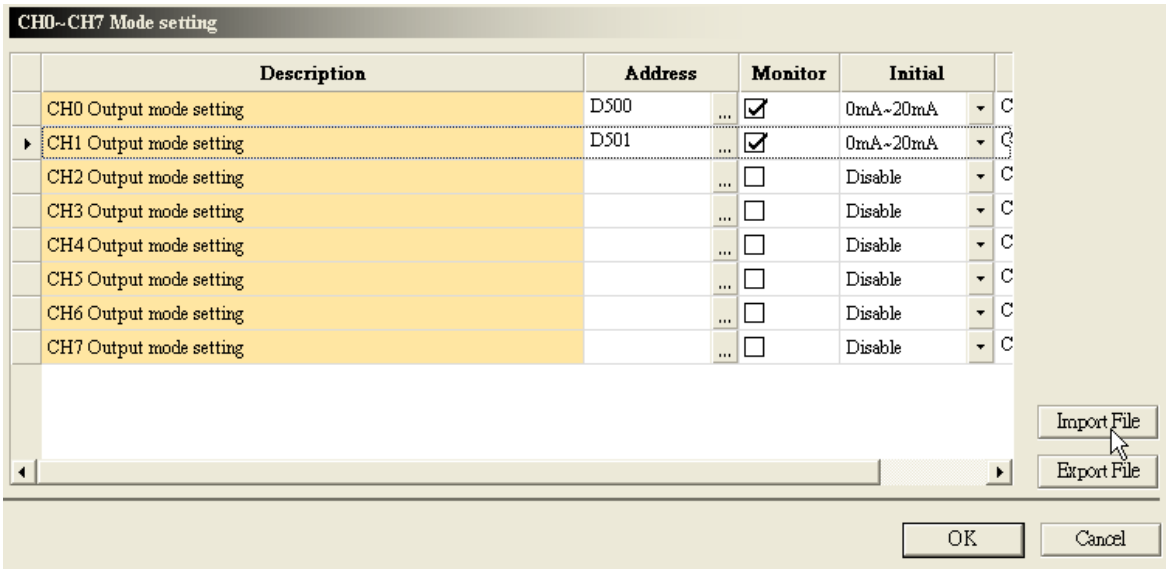
3.4.5 Importing/Exporting a Parameter File

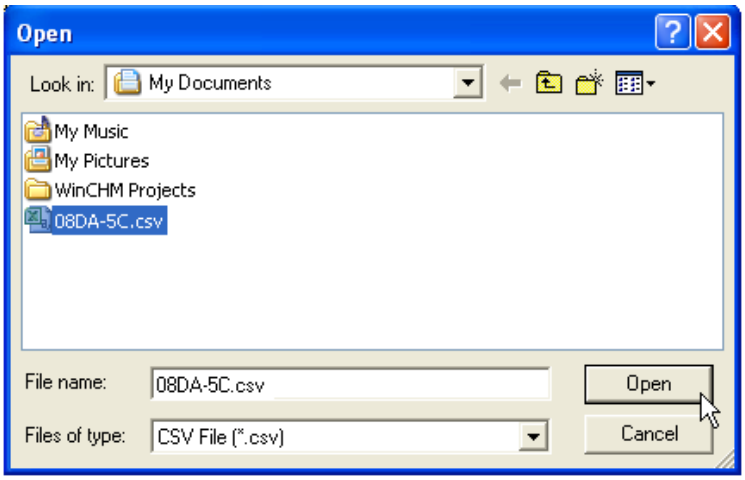
(1) After **Export** is clicked, the parameters will be saved as a CSV file (.csv).





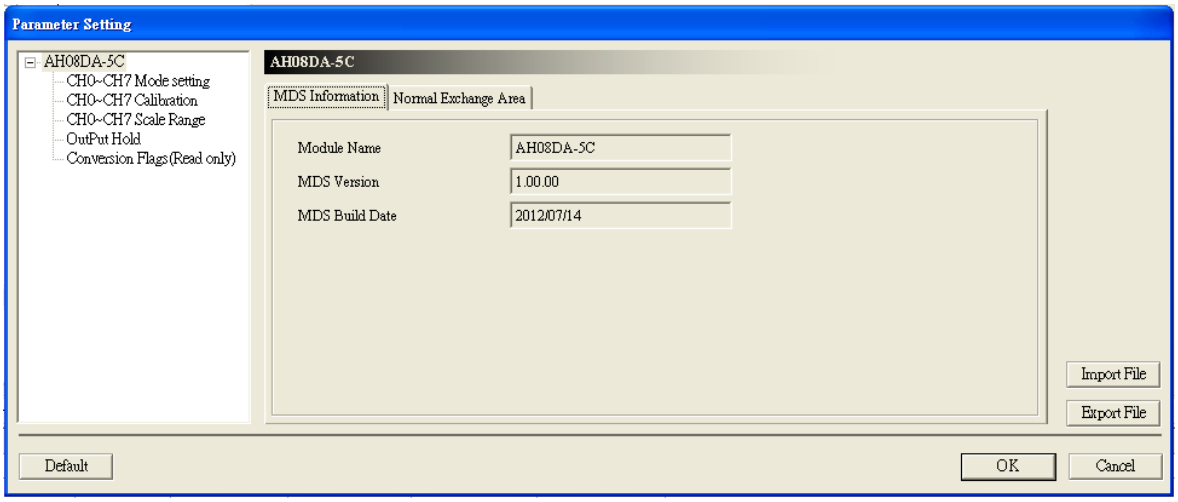
(2) Click **Import**, and then click the CSV file.



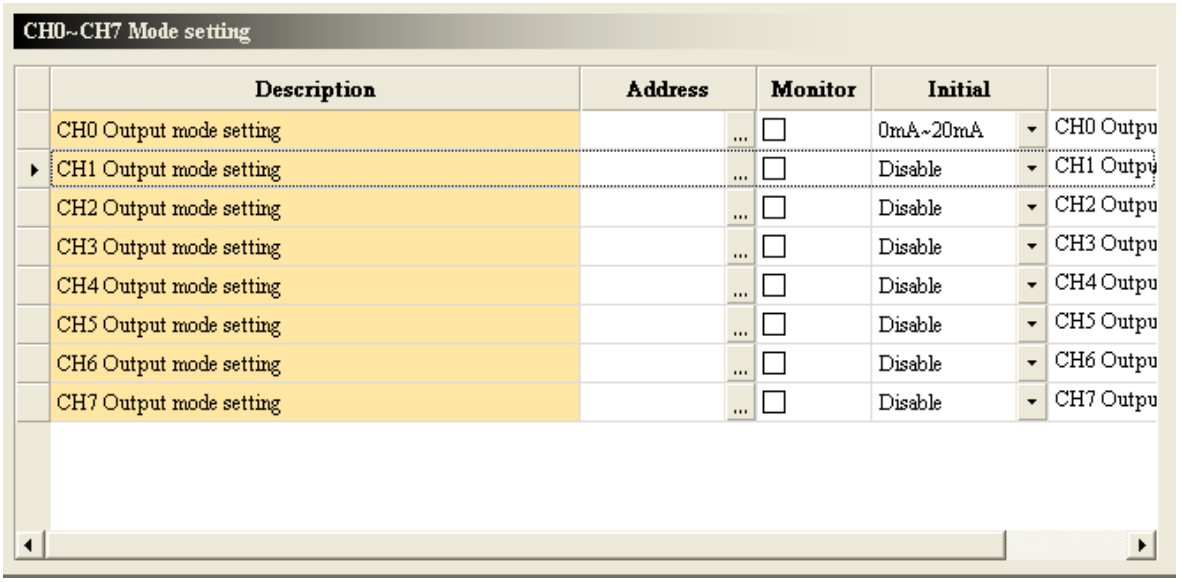


3

3.4.6 Parameters



(1) The output modes of the channels



Module name	AH04DA-5A	AH08DA-5B
Description	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V 6: 0 mA~20 mA 7: 4 mA~20 mA	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V

(2) The offsets and the gains used for calibration

CH0~CH7 Calibration

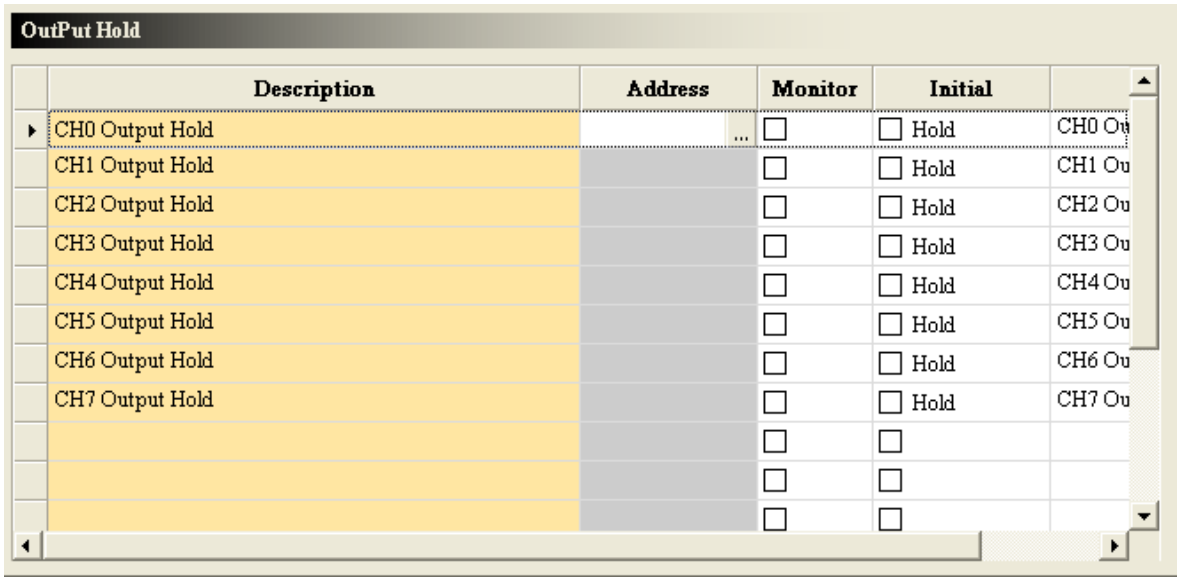
Description	Address	Monitor	Initial	
CH0 Cal. Offset (V/mA)	...	☐	0.000000	CH0 Ca
CH1 Cal. Offset (V/mA)	...	☐	0.000000	CH1 Ca
CH2 Cal. Offset (V/mA)	...	☐	0.000000	CH2 Ca
CH3 Cal. Offset (V/mA)	...	☐	0.000000	CH3 Ca
CH4 Cal. Offset (V/mA)	...	☐	0.000000	CH4 Ca
CH5 Cal. Offset (V/mA)	...	☐	0.000000	CH5 Ca
CH6 Cal. Offset (V/mA)	...	☐	0.000000	CH6 Ca
CH7 Cal. Offset (V/mA)	...	☐	0.000000	CH7 Ca
CH0 Cal. Gain	...	☐	1.000000	CH0 Ca
CH1 Cal. Gain	...	☐	1.000000	CH1 Ca
CH2 Cal. Gain	...	☐	1.000000	CH2 Ca

(3) The scale range

CH0~CH7 Scale Range

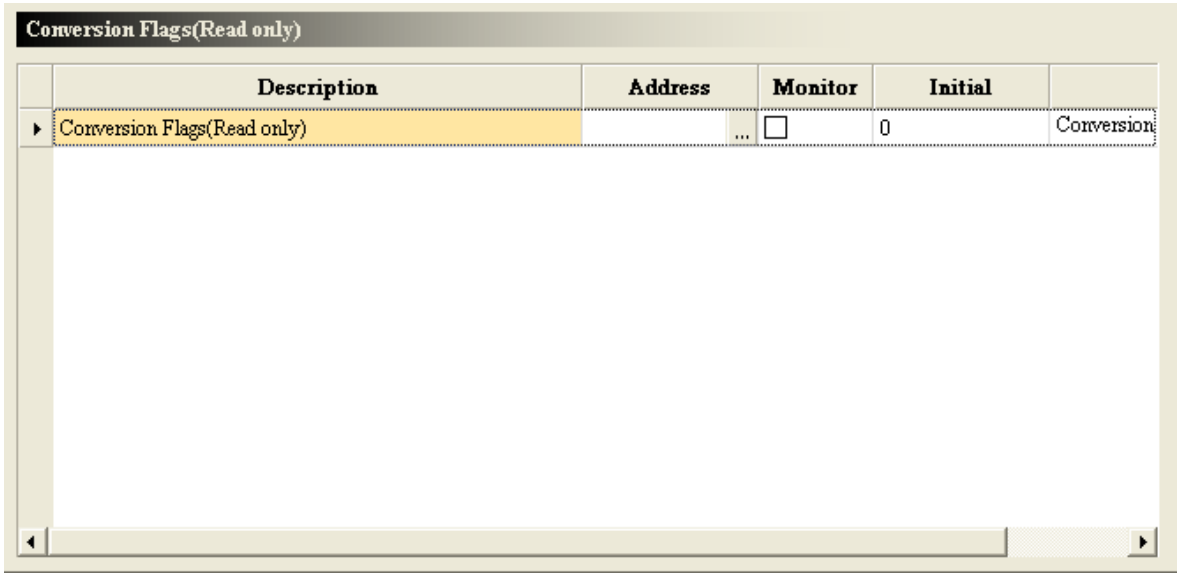
Description	Address	Monitor	Initial	
CH0 Scale LSP	...	☐	0.000000	CH0 Sca
CH1 Scale LSP	...	☐	0.000000	CH1 Sca
CH2 Scale LSP	...	☐	0.000000	CH2 Sca
CH3 Scale LSP	...	☐	0.000000	CH3 Sca
CH4 Scale LSP	...	☐	0.000000	CH4 Sca
CH5 Scale LSP	...	☐	0.000000	CH5 Sca
CH6 Scale LSP	...	☐	0.000000	CH6 Sca
CH7 Scale LSP	...	☐	0.000000	CH7 Sca
CH0 Scale HSP	...	☐	100.000000	CH0 Sca
CH1 Scale HSP	...	☐	100.000000	CH1 Sca
CH2 Scale HSP	...	☐	100.000000	CH2 Sca

(4) Retaining the outputs



Description	bit0~bit7: Retaining the outputs sent by CH0~CH7 (ON: The output is retained. OFF: The output is cleared.)

(5) The error codes



Description	bit0~bit14: Reserved bit15: The external voltage is abnormal.

3.5 Troubleshooting

3.5.1 Error Codes

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A600	Error	Hardware failure	OFF	ON
16#A601	Error	The external voltage is abnormal.	OFF	ON

3.5.2 Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.
The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.

MEMO

Chapter 4 Analog Input/Output Module AH06XA-5A

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4.1 Overview

The specifications for an analog input/output module, the operation, and the programming are described in this chapter. Analog signals (voltages or currents) are received by four channels on an analog input/output module, and are converted into 16-bit digital signals. Besides, the analog input/output module receives two pieces of 16-bit digital data from a CPU module. The digital data is converted into analog signals (voltages or currents). The analog signals are sent by two channels on the analog input/output module.

4.1.1 Characteristics

(1) **AH06XA-5A, an analog input/output module, is used according to practical application.**
CH0~CH3: Inputs received by a channel can be either voltages or currents.
CH0~CH1: Outputs sent by a channel can be either voltages or currents.

(2) **High-speed conversion**
The conversion speed is 150 μs a channel.

(3) **High accuracy**
Conversion accuracy: (The ambient temperature is 25°C.)
Input: The error is ±0.02% of an input voltage, and ±0.05% of an input current.
Output: The error is ±0.05% of an output voltage, and ±0.1% of an output current.

(4) **A scale range can be set by means of software.**
Users can set a scale range in ISPSoft. A scale range is a range of digital values to which a range of analog values corresponds, or a range of digital values corresponding to a range of analog values.

(5) **A module can be set by means of utility software.**
HWCONFIG is built-in utility software in ISPSoft. Users can set modes and parameters in HWCONFIG to complete hardware configuration without spending time writing a program to set registers corresponding to functions.

4.2 Specifications and Functions

4.2.1 Specifications

Electrical specifications

Module name	AH06XA-5A
Number of analog inputs/outpus	4 inputs 2 outputs
Analog-to-digital conversion	Voltage input/Current input/Voltage output/Current output
Supply voltage	24 V DC (20.4 V DC~28.8 V DC) (-15%~+20%)
Connector type	Removable terminal block
Conversion time	150 us/channel
Isolation	There is isolation between a digital circuit and an analog circuit, but there is no isolation between analog channels. Isolation between a digital circuit and a ground: 500 V DC Isolation between an analog circuit and a ground: 500 V DC Isolation between an analog circuit and a digital circuit: 500 V DC Isolation between the 24 V DC and a ground: 500 V DC

Functional specifications for the analog-to-digital conversion

Overall accuracy	25°C (77°F): The error is ±0.02% of an input voltage, and ±0.05% of an input current. -20~60°C (-4~140°F): The error is ±0.15% of an input voltage, and ±0.8% of an input current.

Analog-to-digital conversion	**Voltage input**				
Rated input range	-10 V~10 V	0 V~10 V	±5 V	0 V~5 V	1 V~5 V
Hardware input range	-10.1 V~10.1 V	-0.1 V~10.1 V	-5.05 V~5.05 V	-0.05 V~5.05 V	0.95 V~5.05 V
Fiducial error (25˚C)	±0.02%	±0.01%	±0.02%	±0.02%	±0.02%
Linearity error	±0.02%	±0.03%	±0.01%	±0.01%	±0.02%
Hardware resolution	16 bits				
Input impedance	>200 kΩ				
Absolute input range	±15 V				

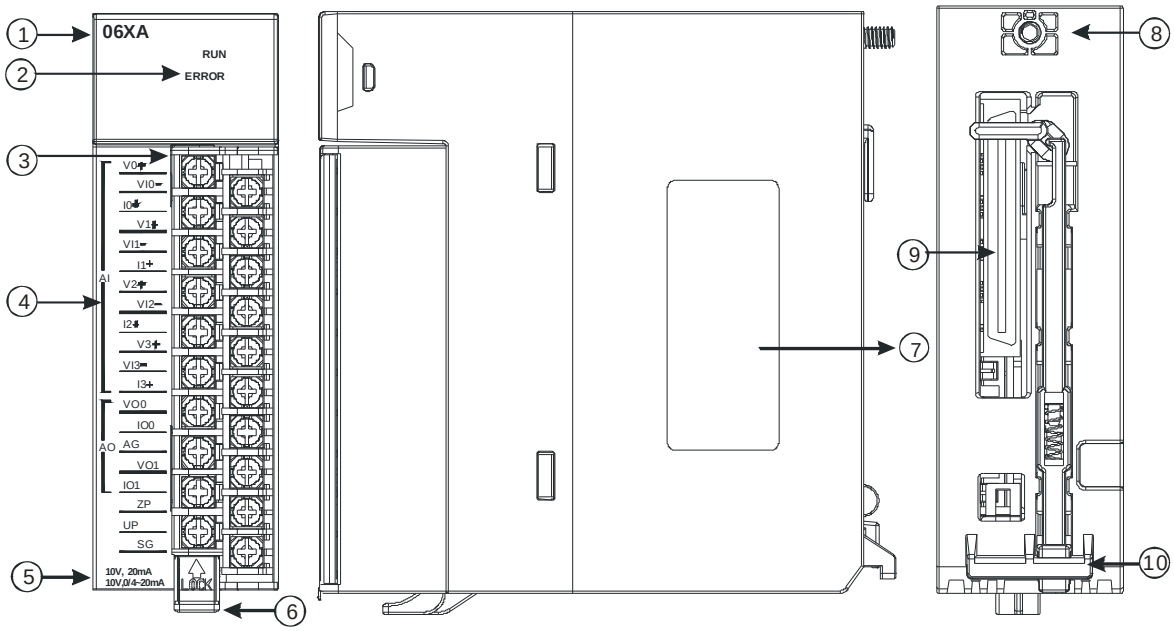
Analog-to-digital conversion	**Current input**		
Rated input range	±20 mA	0 mA~20 mA	4 mA~20 mA
Hardware input range	-20.2 mA~20.2 mA	-0.2 mA~20.2 mA	3.8 mA~20.2 mA
Fiducial error (25˚C)	±0.04%	±0.05%	±0.02%
Linearity error	±0.01%	±0.01%	±0.02%
Hardware resolution	16 bits		
Input impedance	250 Ω		
Absolute input range	±32 mA		

Functional specifications for the digital-to-analog conversion

Overall accuracy	25°C (77°F): The error is ±0.05% of an output voltage, and ±0.1% of an output current. -20~60°C (-4~140°F): The error is ±0.1% of an output voltage, and ±0.15% of an output current.

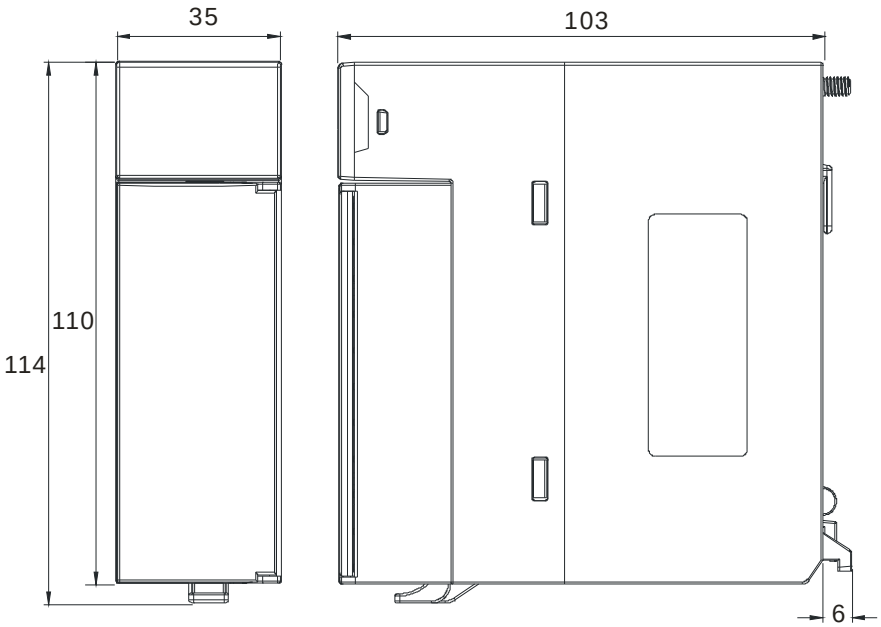
Digital-to-analog conversion	**Voltage output**				
Rated output range	±10 V	0V~10 V	±5 V	0 V~5 V	1 V~5 V
Hardware output range	-10.1 V~10.1 V	-0.1 V~10.1 V	-5.05 V~5.05 V	-0.05 V~5.05 V	0.95 V~5.05 V
Fiducial error (25°C)	±0.01%	±0.02%	±0.01%	±0.01%	±0.01%
Linearity error	±0.006%	±0.01%	±0.01%	±0.02%	±0.02%
Hardware resolution	16 bits				
Permissible load impedance	1 kΩ~2 MΩ: ±10 V and 0 V~10 V ≧500Ω: 1 V~5 V				
Digital-to-analog conversion	**Current output**				
Rated output range	0 mA~20 mA		4 mA~20 mA		
Hardware output range	-0.2 mA~20.2 mA		3.8 mA~20.2 mA		
Fiducial error (25°C)	±0.01%		±0.01%		
Linearity error	±0.01%		±0.01%		
Hardware resolution	16 bits				
Permissible load impedance	≦550 Ω				

4.2.2 Profile



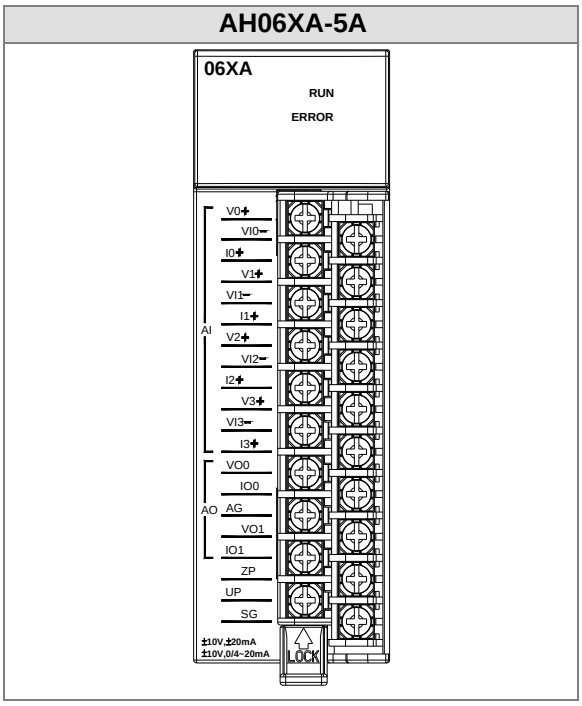
Number	Name	Description
1	Model name	Model name of the module
2	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.
3	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads which will be driven.
4	Arrangement of the input/output terminals	Arrangement of the terminals
5	Description of the inputs/outputs	Simple specifications for the module
6	Clip	Removing the terminal block
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

4.2.3 Dimensions



Unit: mm

4.2.4 Arrangement of Terminals



4.2.5 Functions

HWCONFIG, built-in utility software in ISPSoft, can be used to set a module. Users can set modes and parameters by means of HWCONFIG.

➢ **Analog input**

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Calibration	Users can calibrate a linear curve.
3	Average	Conversion values are averaged and filtered.
4	Scale range	An analog range corresponds to a digital range.
5	Disconnection detection	Only if the analog rang is 4 mA~20 mA or 1 V~5 V does the disconnection detection function.
6	Channel detection	If an input signal exceeds a range of inputs which can be received by hardware, the module will give an alarm or a warning. a. Warning LED indicator: When a warning occurs, the ERROR LED indicator blinks or does not blink. b. Interrupt: An interrupt service routine is enabled.

1. Enabling/Disabling a channel

The conversion speed is 150 μs a channel, and the total conversion time is 150 μs×(the number of channels). If a channel is not used, users can disable it to decrease the total conversion time.

2. Calibration

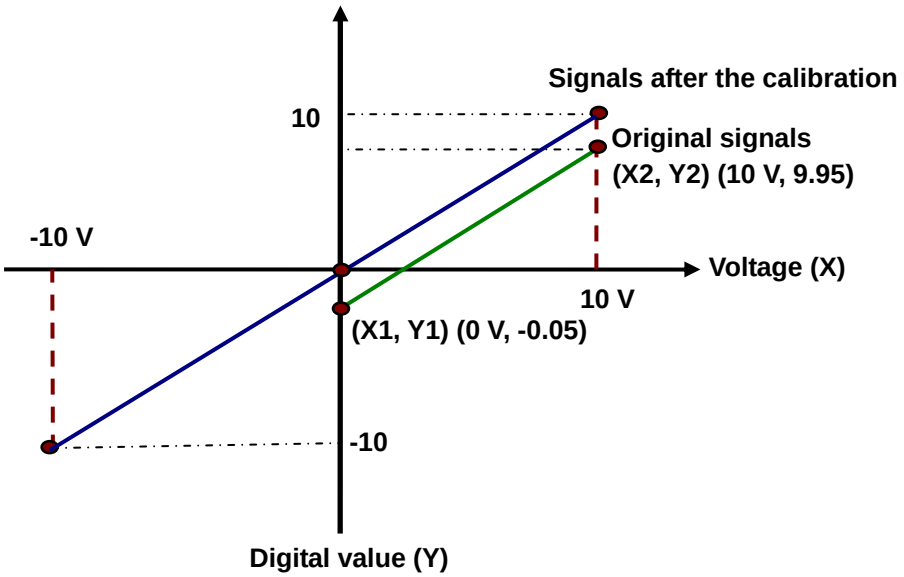
- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of inputs which can be sent by hardware.
- A volt is a unit of calibration for offsets if inputs received or outputs sent are voltages. A milliampere is a unit of calibration for offsets if inputs received or outputs sent are currents.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

Example 1:

The inputs received by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. If the voltage received by the channel is 0 V, the digital value is -0.05. If the voltage received by the channel is 10.0 V, the digital value is 9.95. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[9.95-(-0.05)]/(10-0)=1
Gain used for calibration=1/Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1= -0.05
Offset used for calibration=0-Y1=0.05



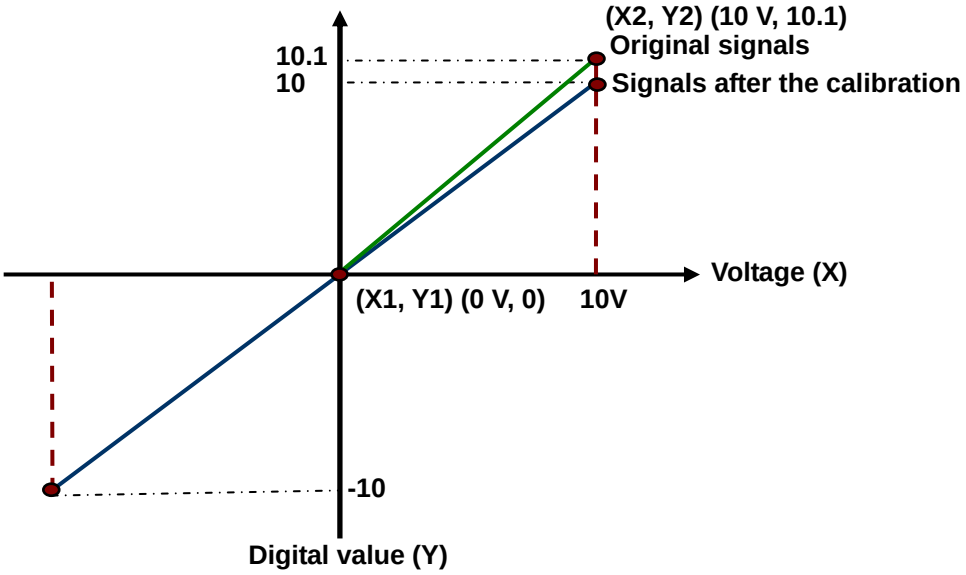
(X: Analog signal; Y: Digital value)

Example 2:

The inputs received by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. If the voltage received by the channel is 0 V, the digital value is 0.0. If the voltage received by the channel is 10.0 V, the digital value is 10.1. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[10.1-0]/(10-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



(X: Analog signal; Y: Digital value)

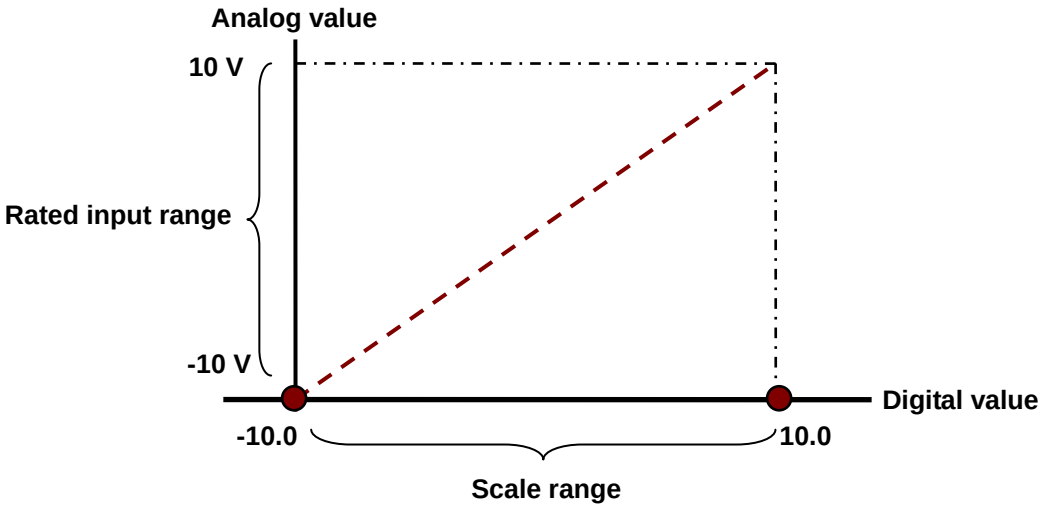
4

3. Average

Digital values are averaged. The number by which the sum of several digital values is divided is between 1 and 100. The sampled values are taken as a queue, and the length of the queue is N. Each time a new sampled value is put at the end of the queue, an original value at the start of the queue is removed. The N values are averaged so that the periodic noise is suppressed.

4. Scale range

The analog input mode of a channel has a corresponding digital range, that is, an analog range corresponds to a digital range. For example, if the analog range is -10V~10V and the digital range is -10.0~10.0, the analog values -10 V~10 V correspond to the digital values -10.0~10.0.



5. Disconnection detection

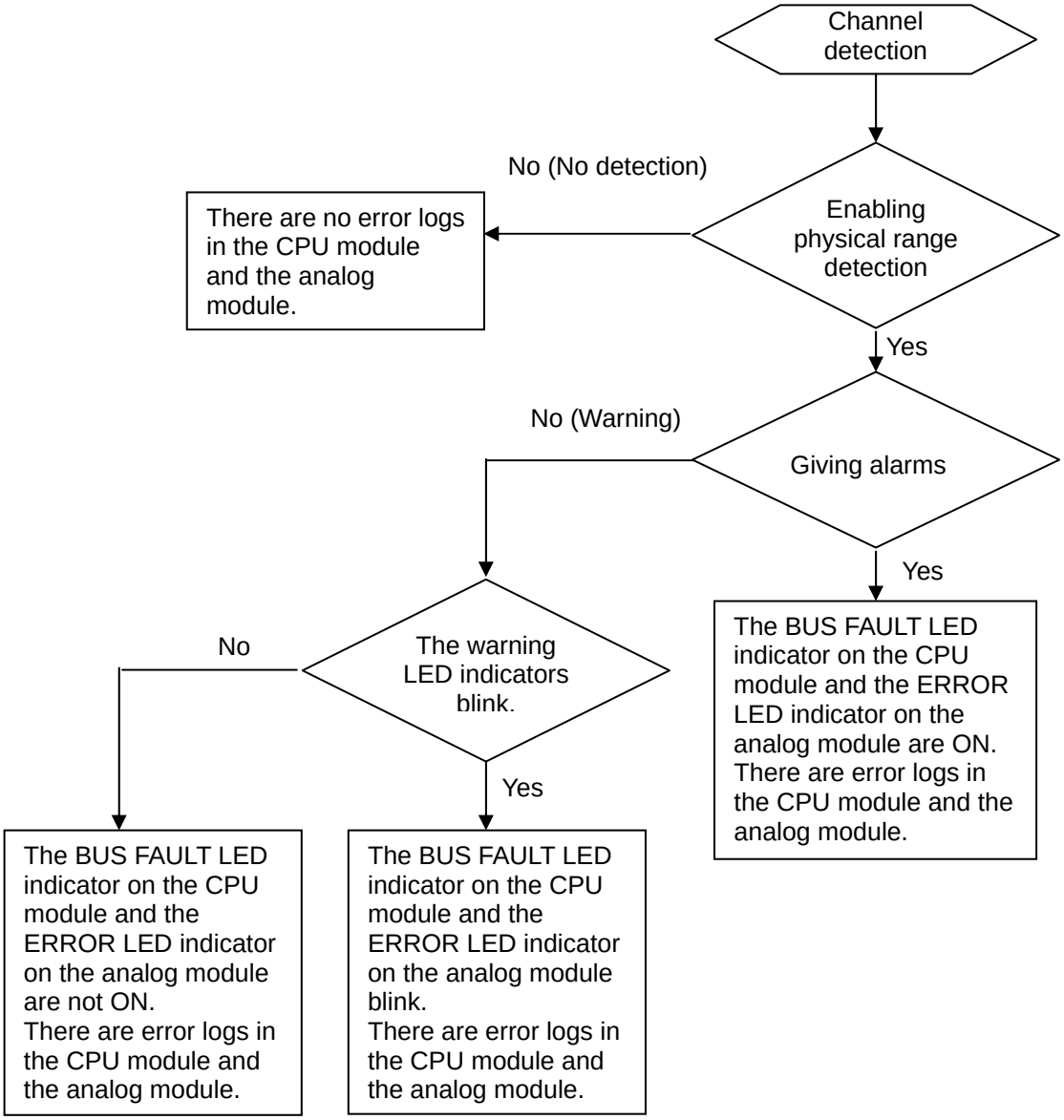
Only if the analog rang is 4 mA~20 mA or 1 V~5 V does the disconnection detection function. If a module which can receive inputs ranging from 4 mA to 20 mA or from1 V to 5V is disconnected, an input signal will exceed the range of inputs which can be received by the hardware, and the module will give an alarm or a warning. Please refer to the description below for more information.

6. Channel detection

If an input signal exceeds a range of inputs which can be received by hardware, an error message appears. Please refer to section 4.2.1 for more information.

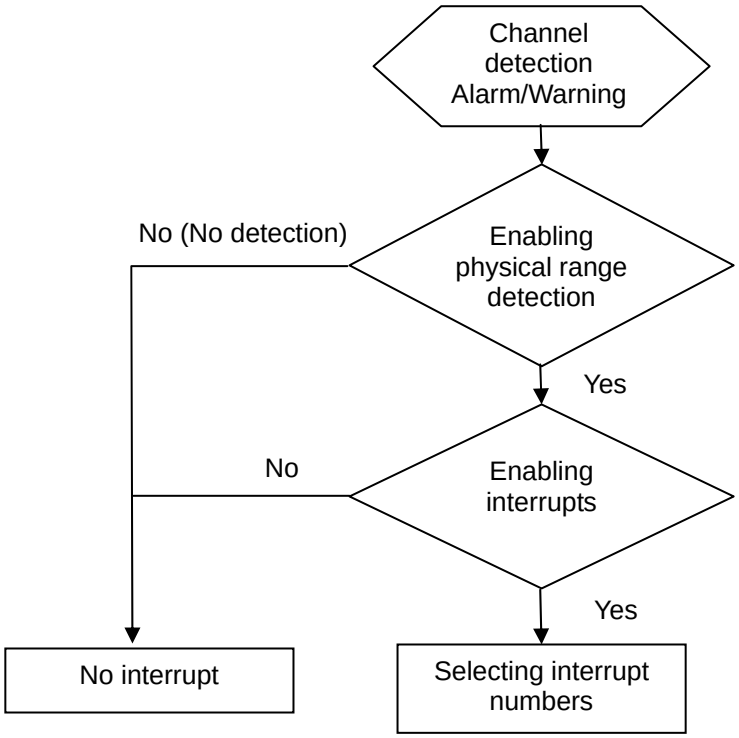
a. Giving alarms or warnings

The procedure below explains how to set a module so that it gives an alarm or a warning.


Channel detection
Enabling physical range detection
No (No detection)
There are no error logs in the CPU module and the analog module.
Yes
Giving alarms
No (Warning)
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module are ON. There are error logs in the CPU module and the analog module.
The warning LED indicators blink.
No
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module are not ON. There are error logs in the CPU module and the analog module.
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the analog module blink. There are error logs in the CPU module and the analog module.

b. Interrupt service routine

The procedure below explains how to trigger an interrupt service routine in a CPU module.



- The interrupt service routines are I40~I251.

➢ **Analog output**

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Calibration	Users can calibrate an analog output curve.
3	Scale range	A digital range corresponds to an analog range.
4	Retaining an output	When a module stops running, a signal sent by the module is retained.

1. Enabling/Disabling a Channel

The conversion speed is 150 μs a channel, and the total conversion time is 150 μs×(the number of channels). If a channel is not used, users can disable it to decrease the total conversion time.

2. Calibration

- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of outputs which can be sent by hardware.
- A volt is a unit of calibration for offsets if inputs received or outputs sent are voltages. A milliampere is a unit of calibration for offsets if inputs received or outputs sent are currents.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

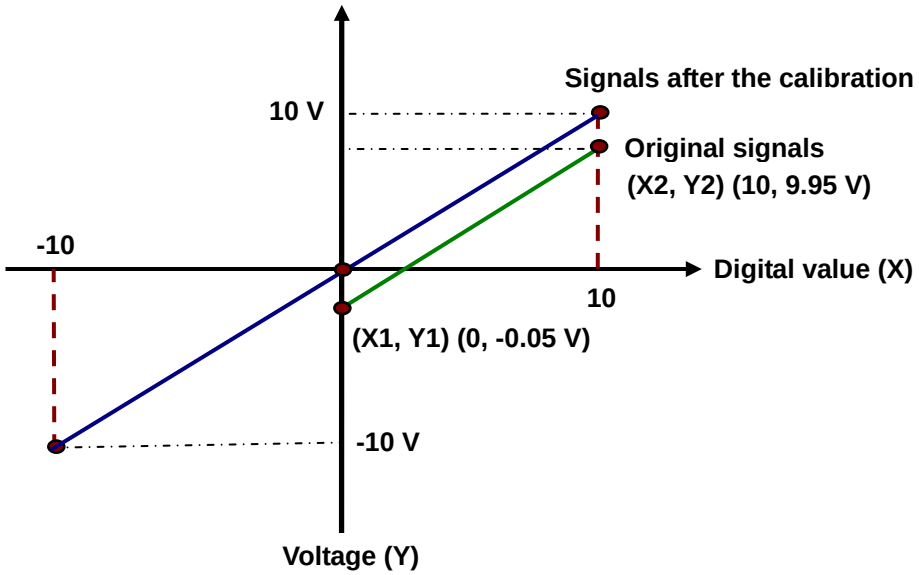
Example 1:

The outputs sent by a channel are voltages in the range of -10.0 V to +10.0 V. The original

signals are used. The gain is 1, and the offset is 0. The digital value received by the channel is 0, and the voltage measured is -0.05 V. The digital value received by the channel is 10, and the voltage measured is 9.95 V. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[9.95-(-0.05)]/(10-0)=1
Gain used for calibration=1/ Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=-0.05
Offset used for calibration=0-Y1=0.05



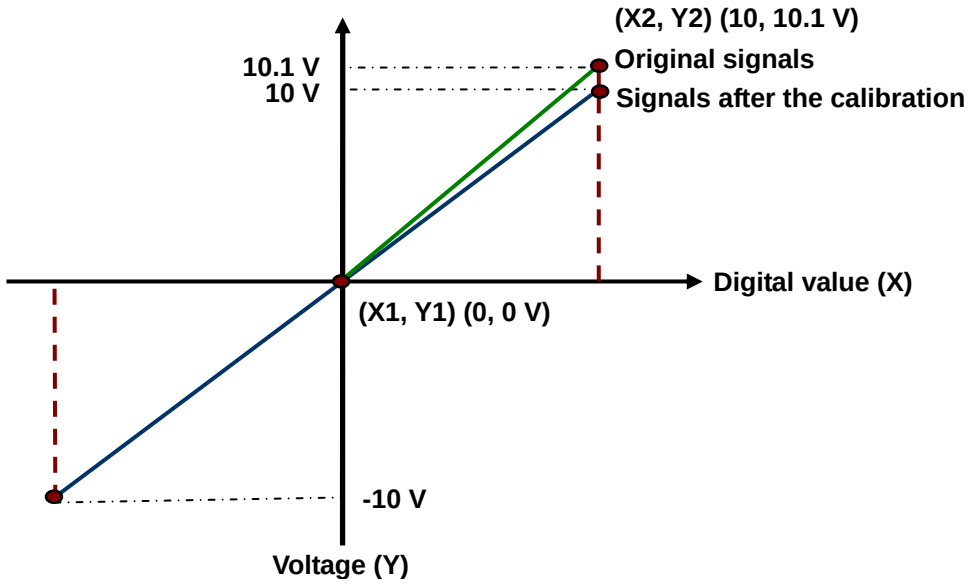
(X: Digital value; Y: Analog signal)

Example 2:

The outputs sent by a channel are voltages in the range of -10.0 V to +10.0 V. The original signals are used. The gain is 1, and the offset is 0. The digital value received by the channel is 0, and the voltage measured is 0 V. The digital value received by the channel is 10, and the voltage measured is 10.1 V. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[10.1-0]/(10-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

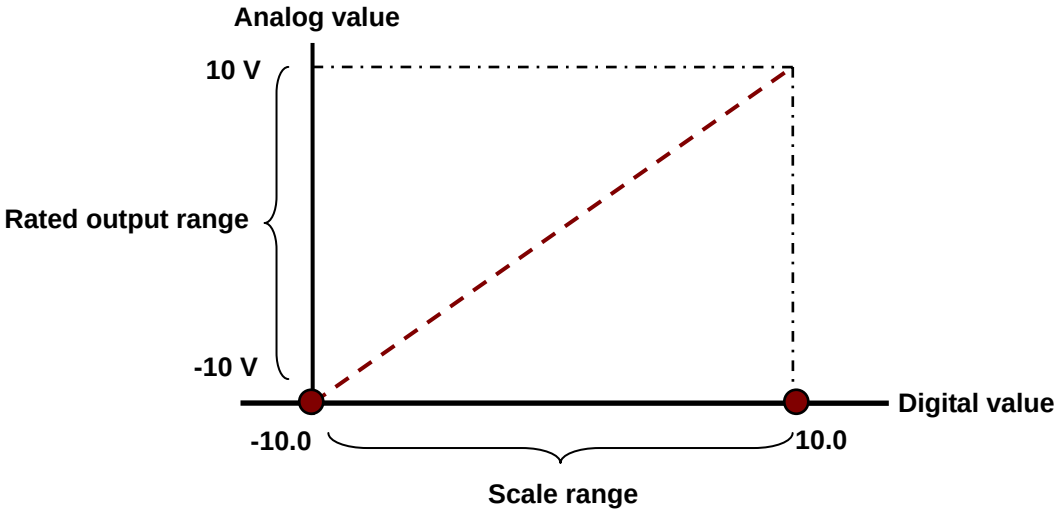
The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



(X: Digital value; Y: Analog signal)

3. Scale range

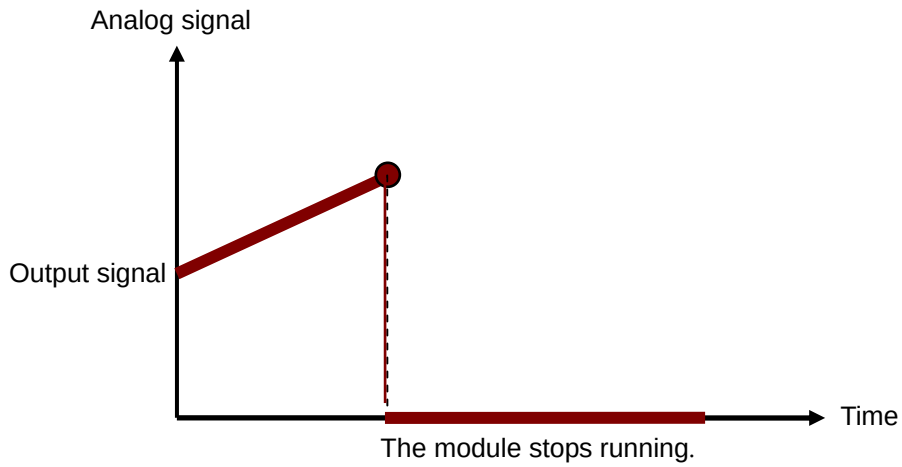
The analog output mode of a channel has a corresponding digital range. Digital values correspond to analog outputs sent by a module. For example, if the analog range is -10 V~10 V and the digital range is -10.0~10.0, the digital values -10.0~10.0 correspond to the analog values -10 V~10 V.



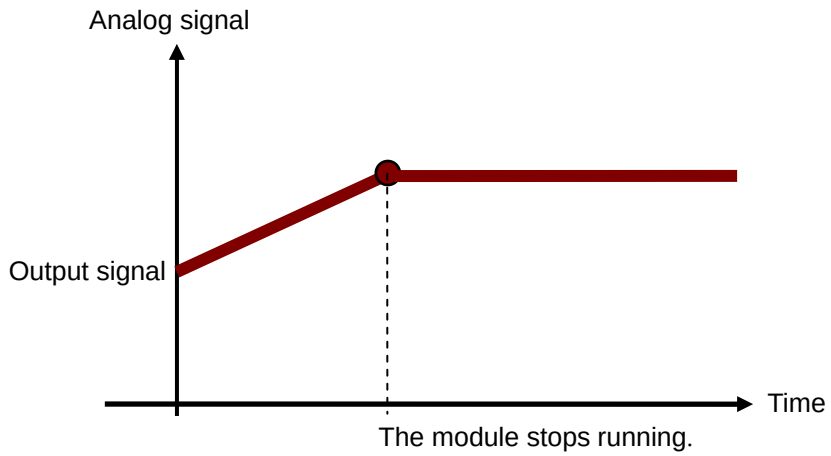
4. Retaining an output

When a module stops running, a signal sent by the module is retained.

The output is not retained:



The output is retained:

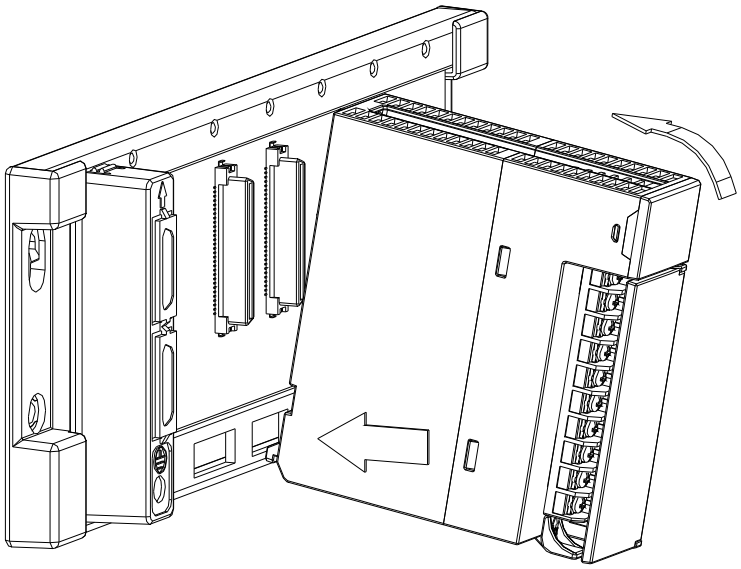


4.3 Installation

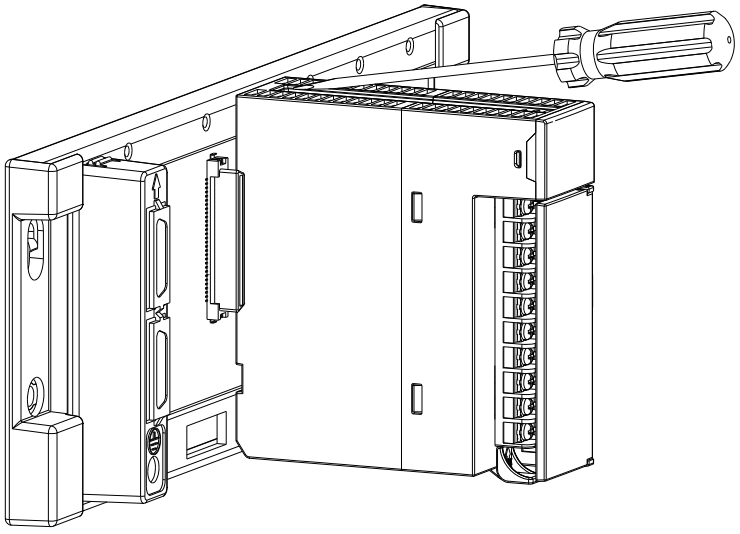
4.3.1 Installing a Module

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.

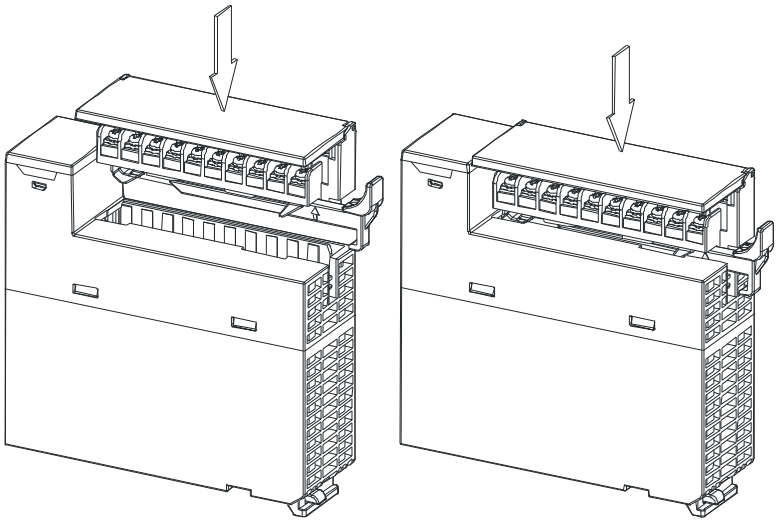


3. Tighten the screw on the module.

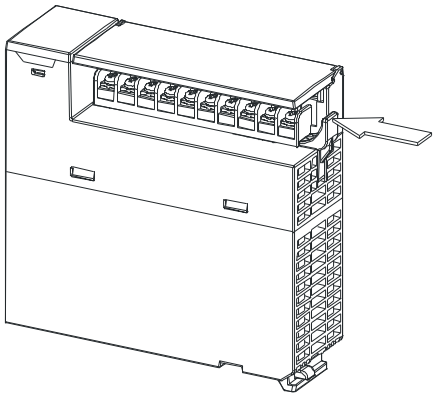


4.3.2 Installing a Removable Terminal Block

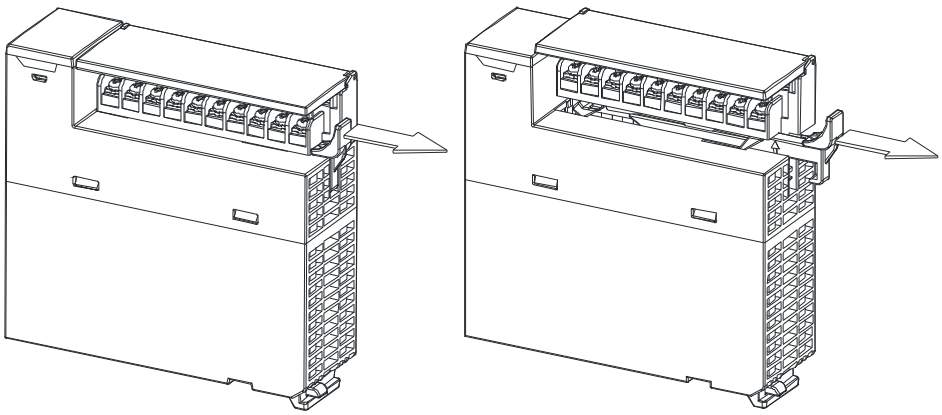
- **Installation**
  1. Level a terminal block at the printed circuit board, and press it into the module.



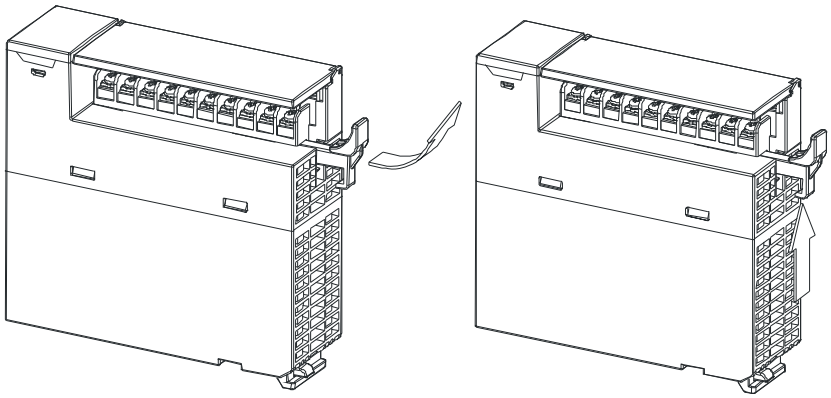
  2. Press the clip in the direction indicated by the arrow.



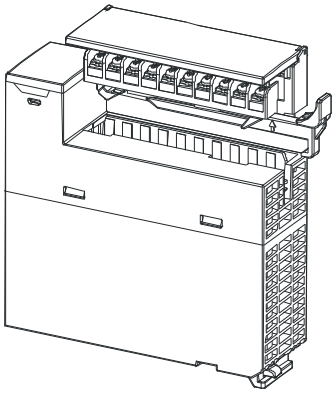
- **Removal**
  1. Pull the clip in the direction indicated by the arrow.



2. Pull up the clip.



3. The terminal block is removed.



4.3.3 Wiring

- **Precautions**

  In order to make the functions of AH06XA-5A perfect and ensure the reliability of a system at the same time, external wiring which prevents noise is necessary. Before installing cables, users need to follow the precautions below.

  (1) To prevent a surge and induction, an AC cable and input/output signal cables which are connected to AH06XA-5A must be separate cables.

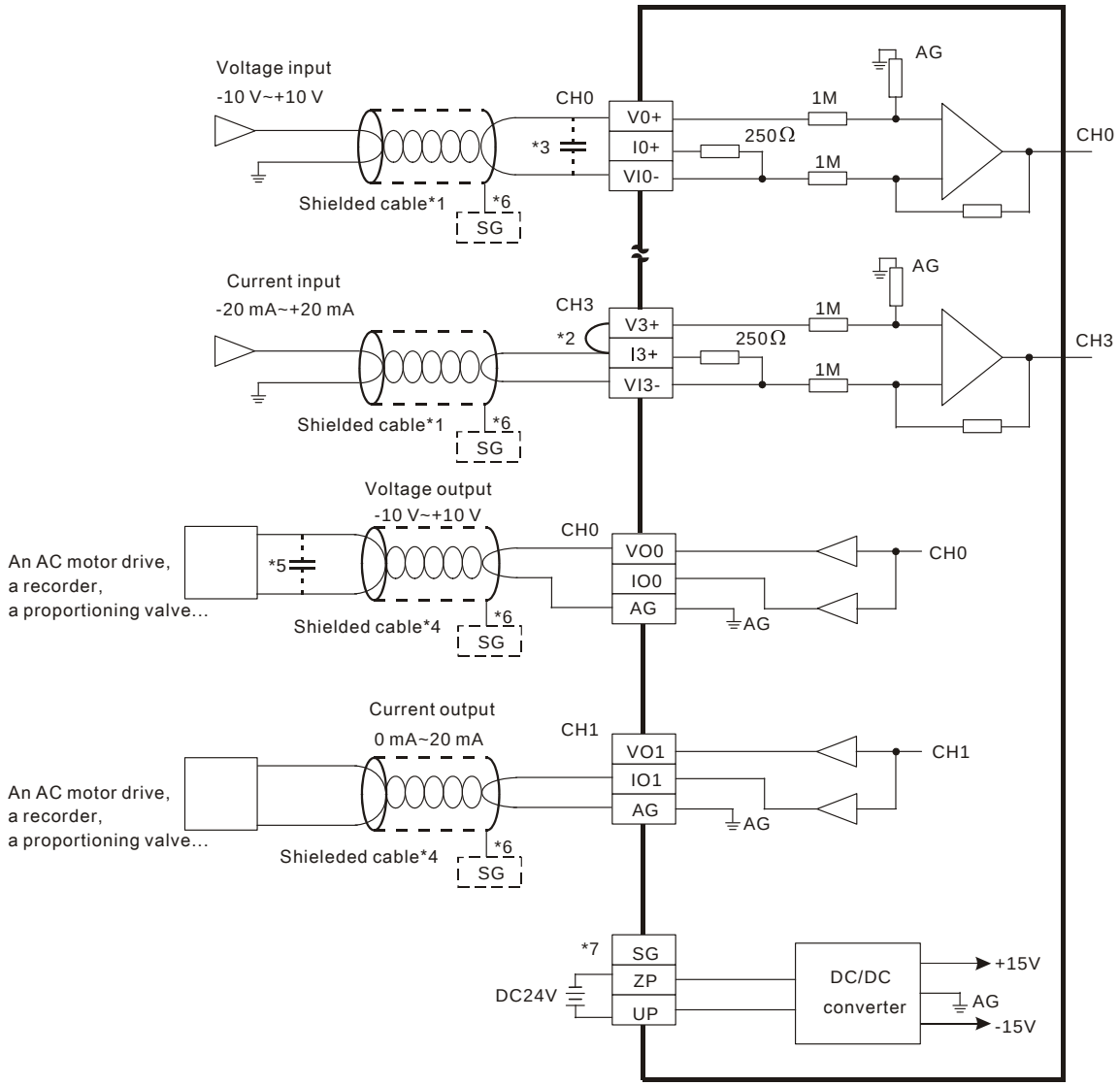
  (2) A cable must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Besides, a cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Otherwise, effects that noise, induction, and a surge have will increase.

  (3) Please connect a shielded cable and a hermetically sealed cable with the ground separately.

  (4) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.

- **External wiring**

  (1) AH06XA-5A



*1. Please isolate the analog input signal cables from other power cables.

*2. If the module is connected to a current signal, the terminals V+ and I+ have to be short-circuited.

*3. If the ripple in the input voltage results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*4. Please isolate the analog output signal cables from other power cables.

*5. If the ripple is large for the input terminal of the load and results in the noise interference with the wiring, please connect the module to the capacitor having a capacitance in the range of 0.1 μF to 0.47 μF with a working voltage of 25 V.

*6. Please connect the shielded cables to the terminal SG.

*7. Once AH06XA-5A is installed on a backplane, the terminal SG on AH06XA-5A and the terminal ⏚ on the backplane will be short-circuited. Please connect the terminal ⏚ on the backplane to the ground terminal ⏚.

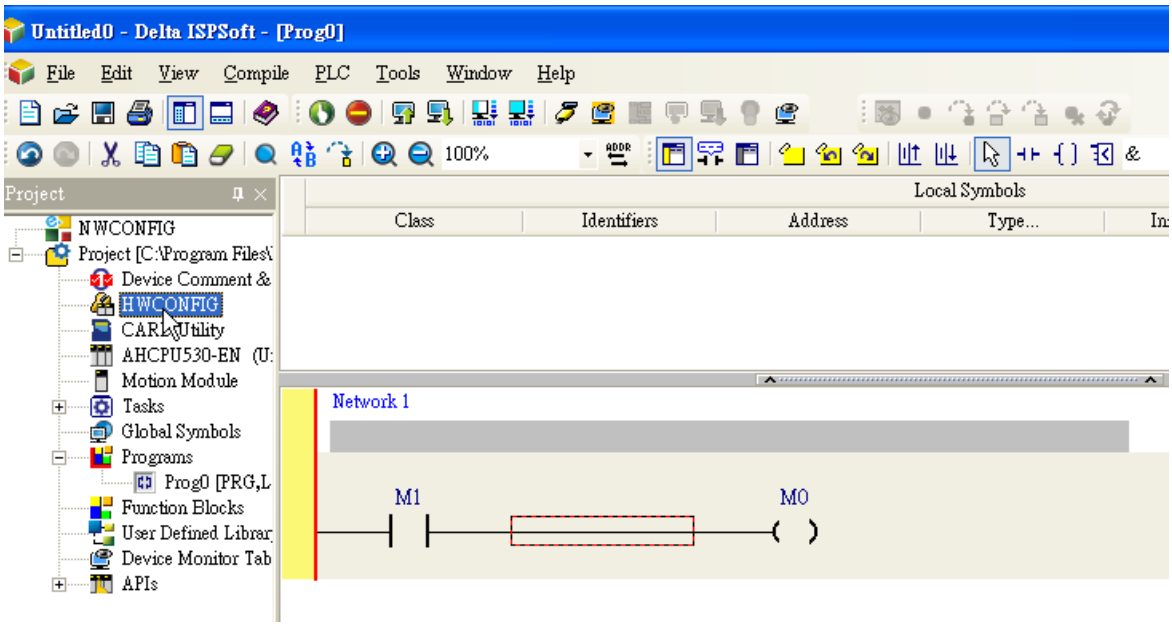
4.3.4 LED Indicators

Number	Name	Description
1	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
2	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.

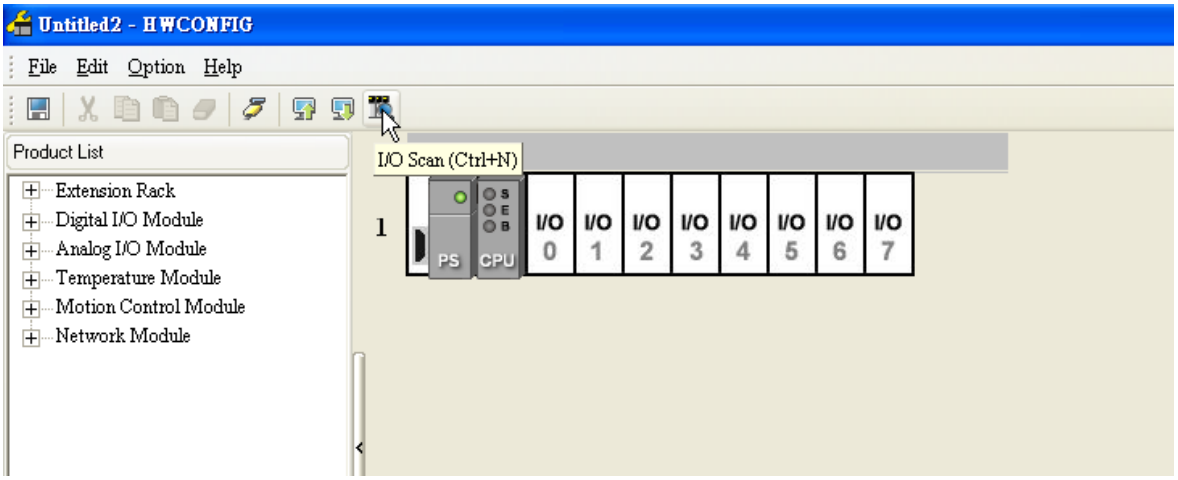
4.4 HWCONFIG in ISPSoft

4.4.1 Initial Setting

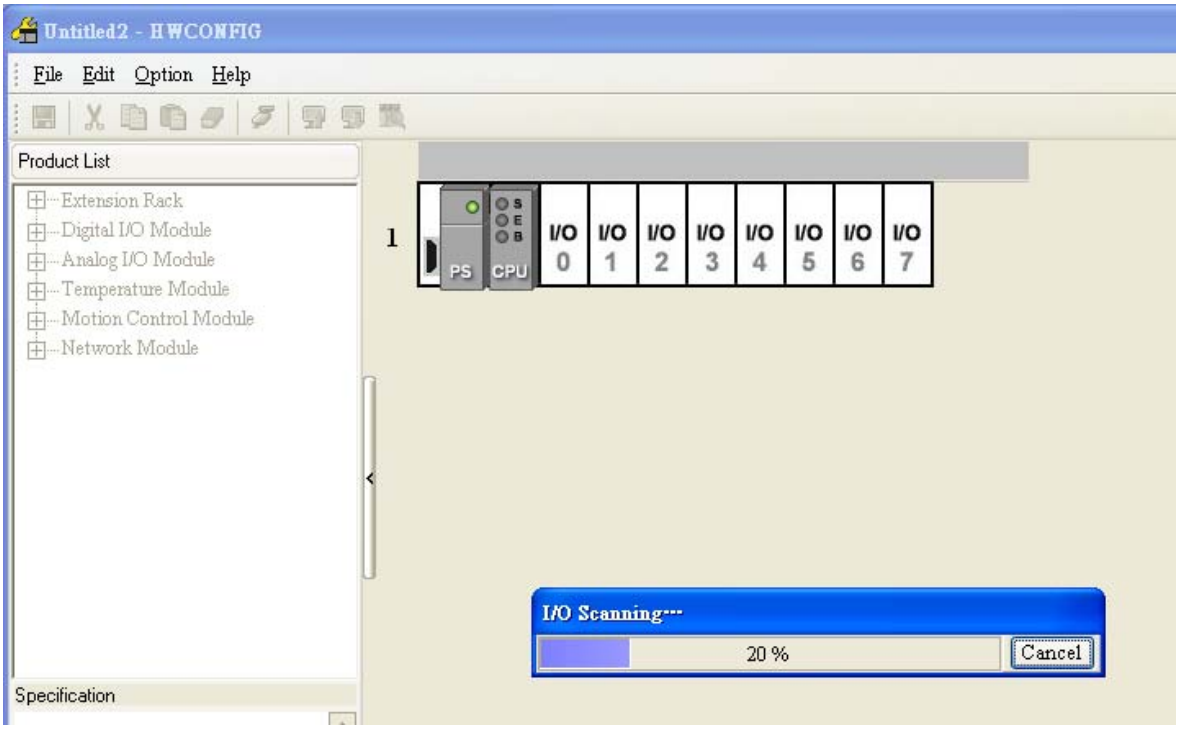
(1) Start ISPSoft, and then double-click **HWCONFIG**.



(2) Click **I/O scan** on the toolbar.



(3) ISPSoft is scanning the actual hardware configuration.



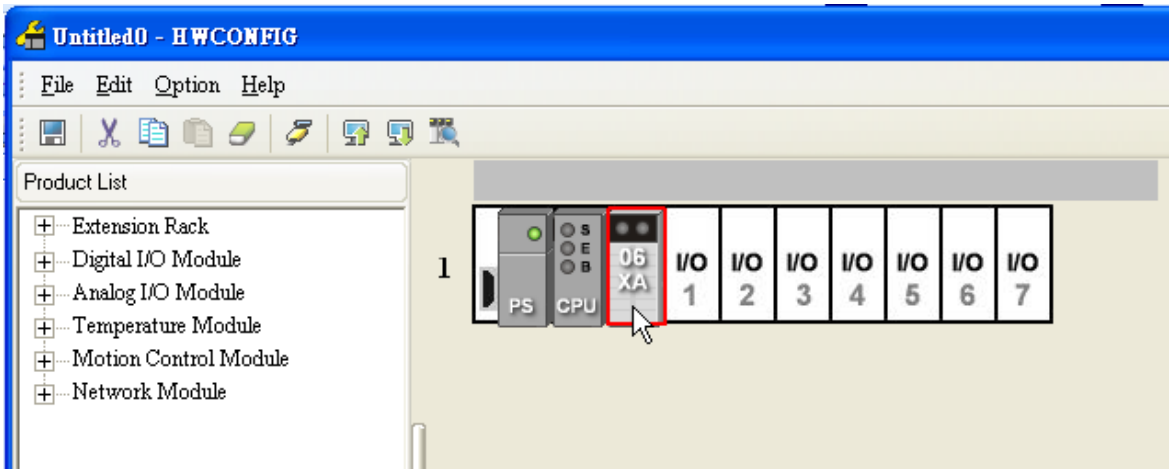
(4) After the scan of the actual hardware configuration is complete, the system automatically assigns the corresponding registers to the channels. Users can alter the input device range and the output device range by themselves.

Note: Owing to the fact that values are floating-point numbers, every channel occupies two 16-bit registers.

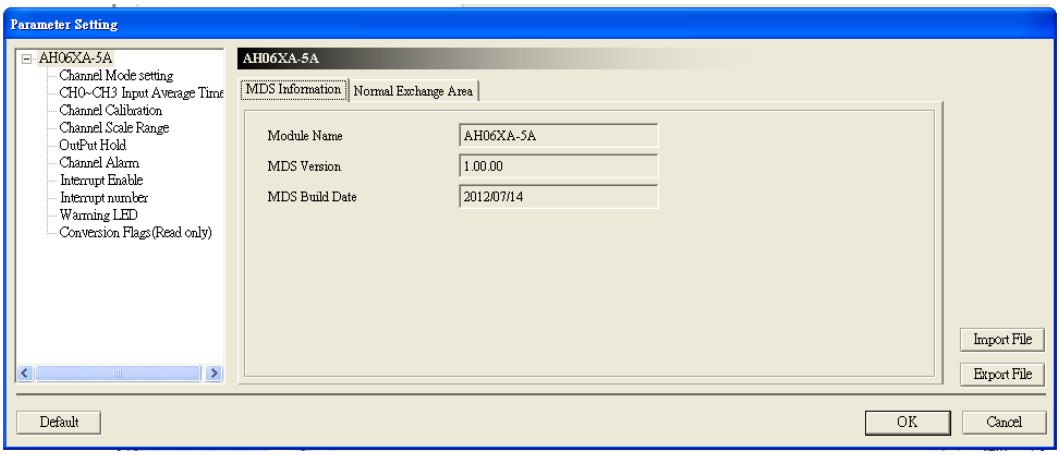
Information: Rack 1

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range
-	AHPS05-5A	-	AH Power Supply Modul	None	None
-	AHCPU530-EN	1.00	Basic CPU module buildi	None	None
0	AH06XA-5A	1.00	4 x 16 bit AI, 2 x 16bit AO	D0 ~ D7	D8 ~ D11

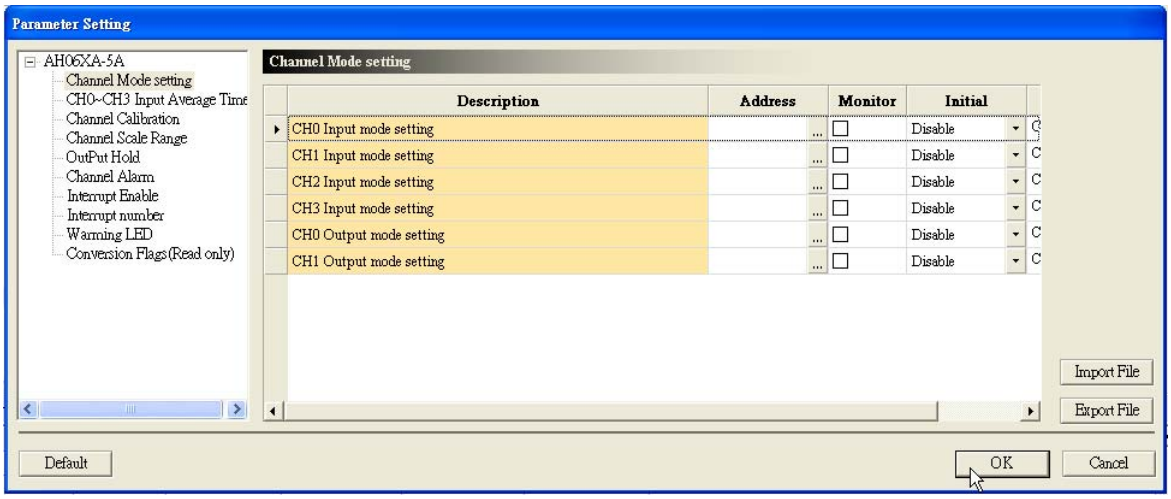
(5) Double-click the module AH06XA-5A.



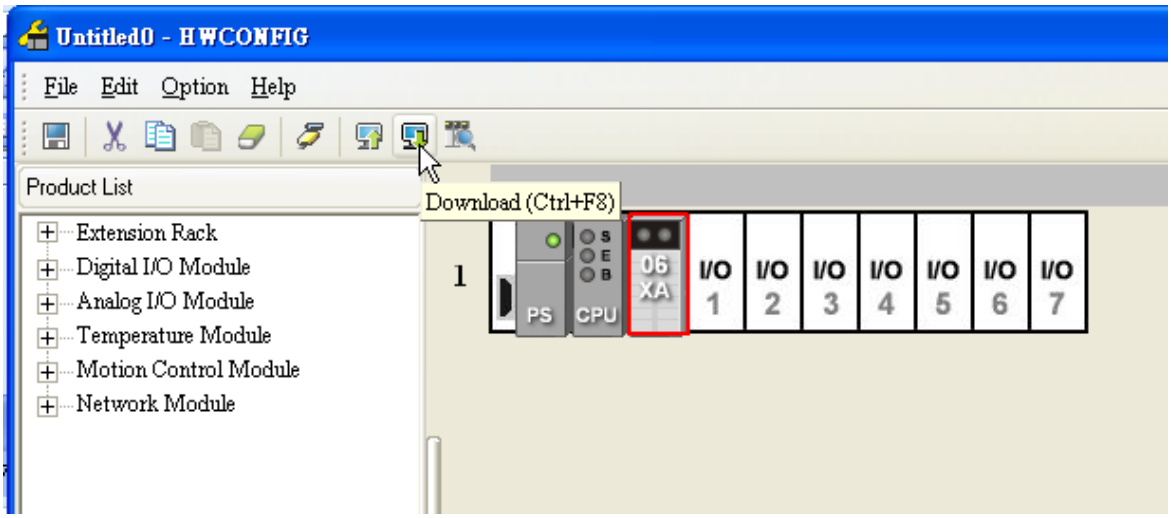
(6) Open the **Parameter Setting** window.



(7) Set the parameters, and then click **OK**.

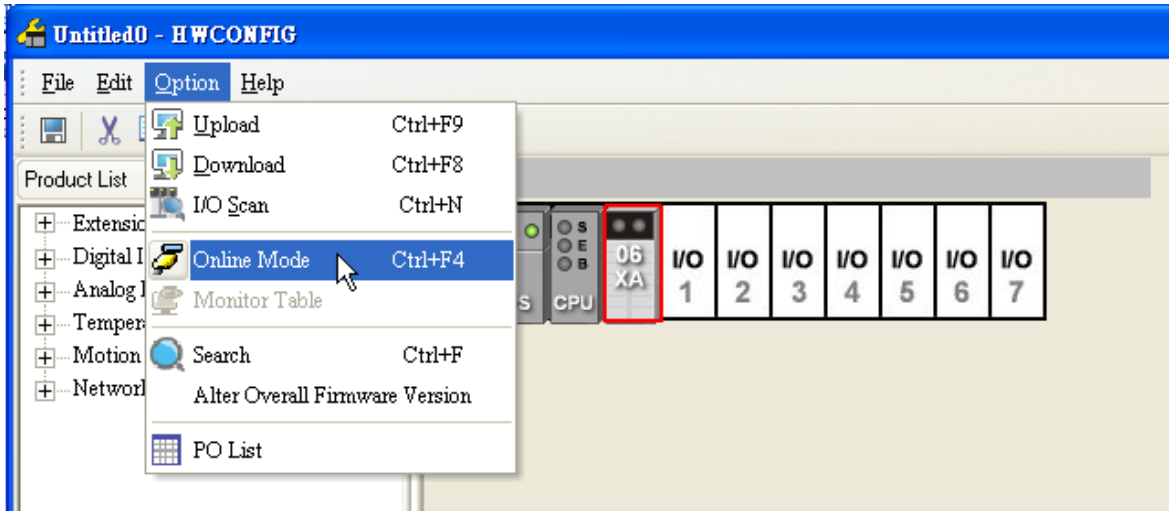


(8) Click **Download** on the toolbar to download the parameters. (The parameters can not be downloaded when the CPU module runs.)

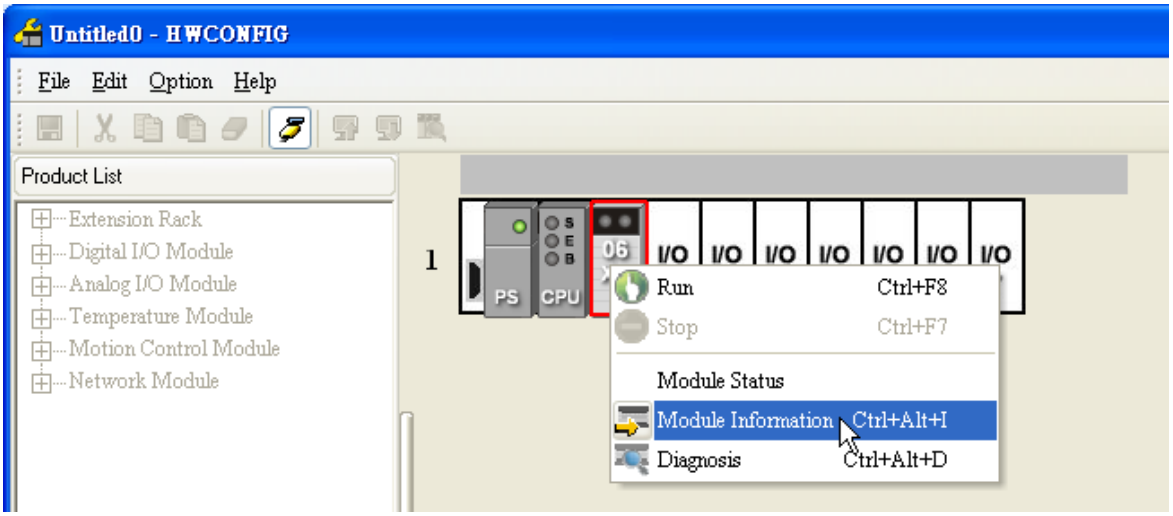


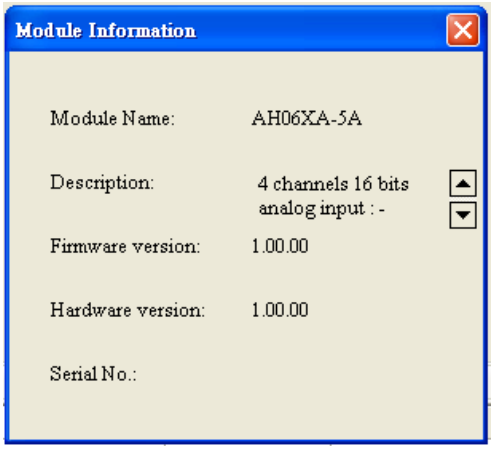
4.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



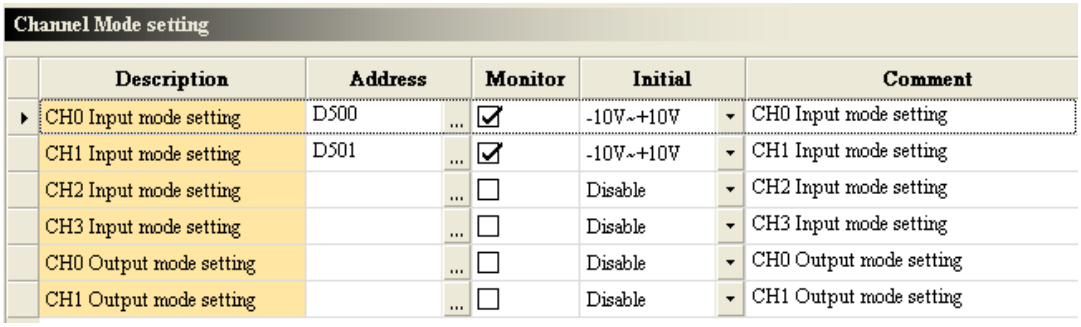
(2) Right-click the module, and then click **Module Information** on the context menu. The version of the firmware and that of the hardware are displayed.



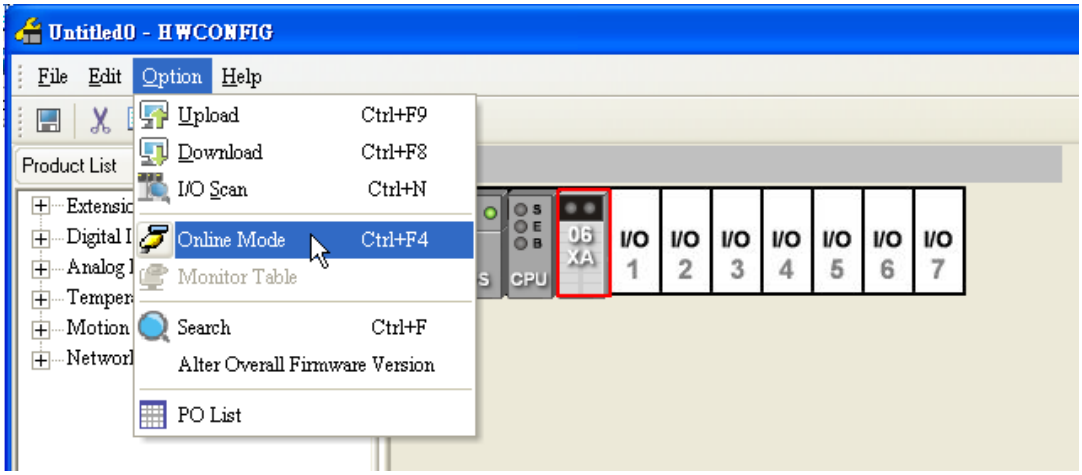


4.4.3 Monitoring Table

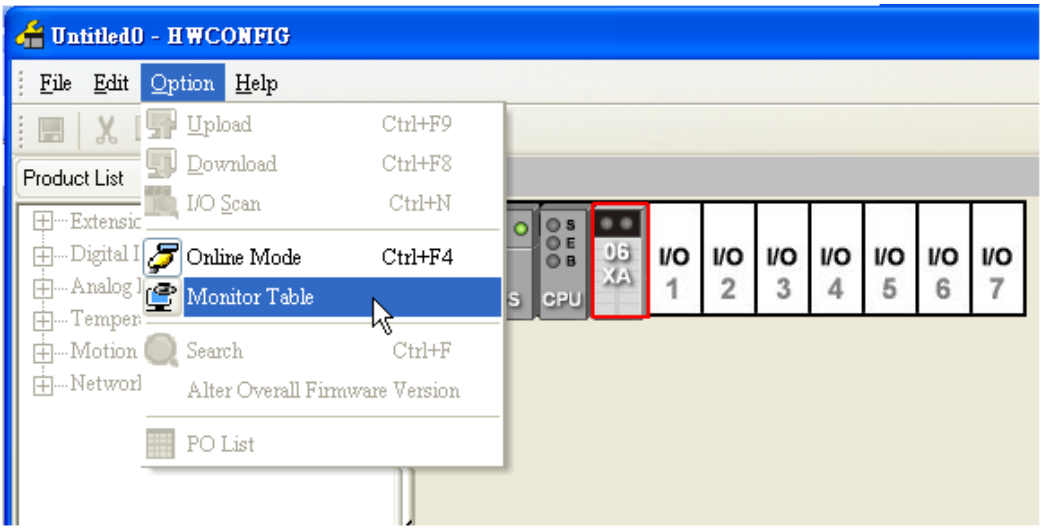
(1) Select the **Monitor** checkboxes at the right sides of the corresponding registers.

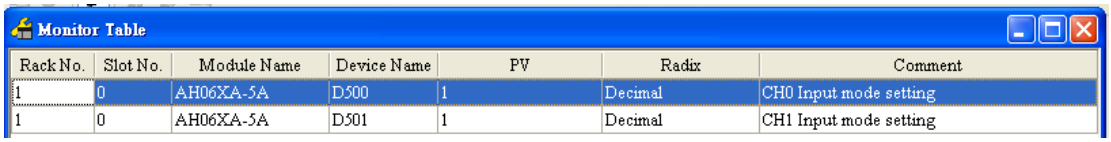


(2) On the **Option** menu, click **Online Mode**.



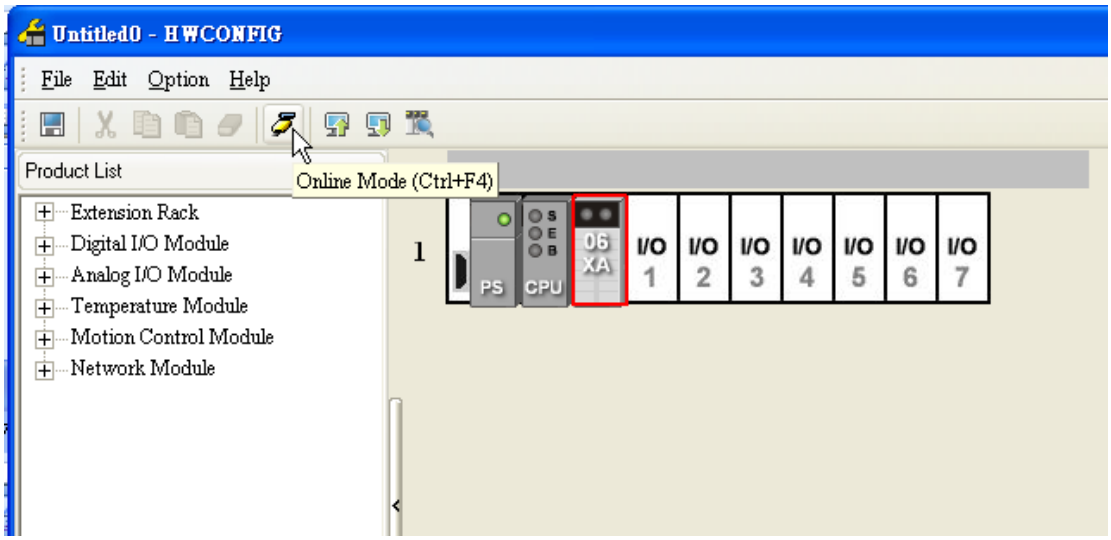
(3) On the **Option** menu, click **Monitor Table**. The registers are monitored.



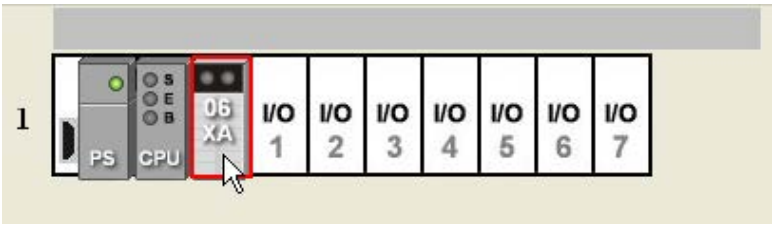

Monitor Table
Rack No. | Slot No. | Module Name | Device Name | PV | Radix | Comment
1 | 0 | AH06XA-5A | D500 | 1 | Decimal | CH0 Input mode setting
1 | 0 | AH06XA-5A | D501 | 1 | Decimal | CH1 Input mode setting

4.4.4 Online Mode

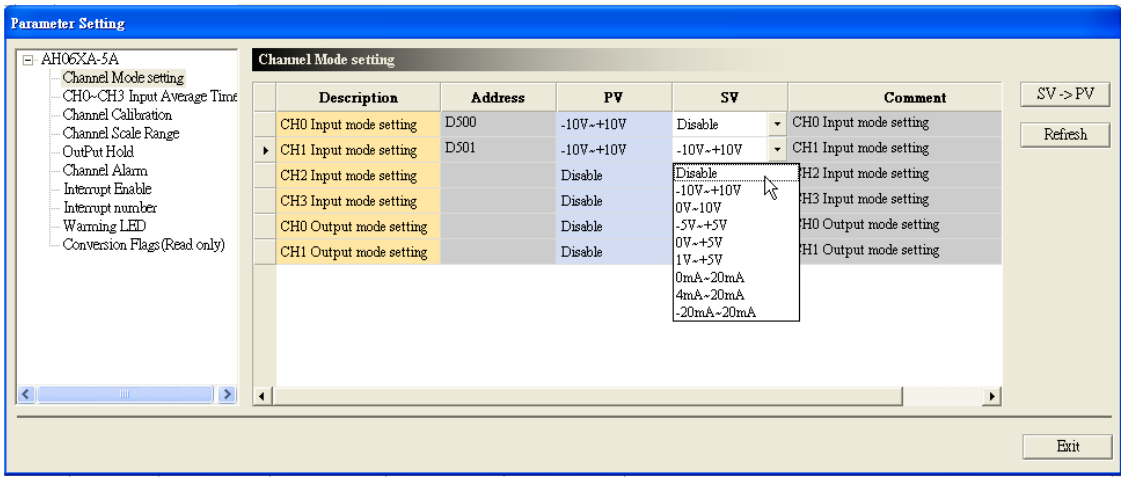
(1) Click **Online Mode** on the toolbar.



(2) Double-click the module AH06XA-5A.

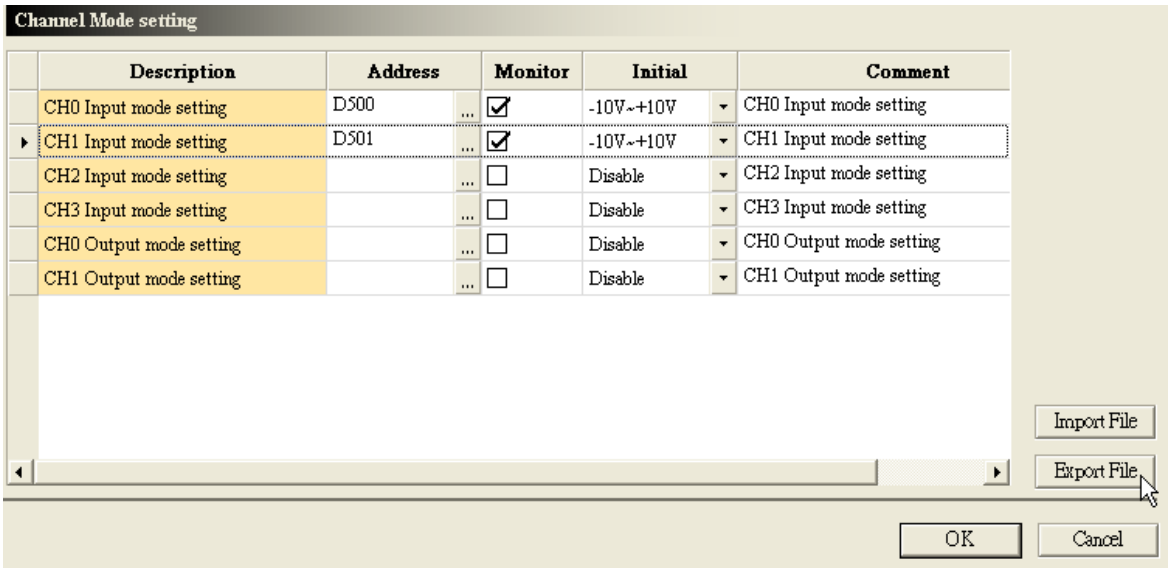


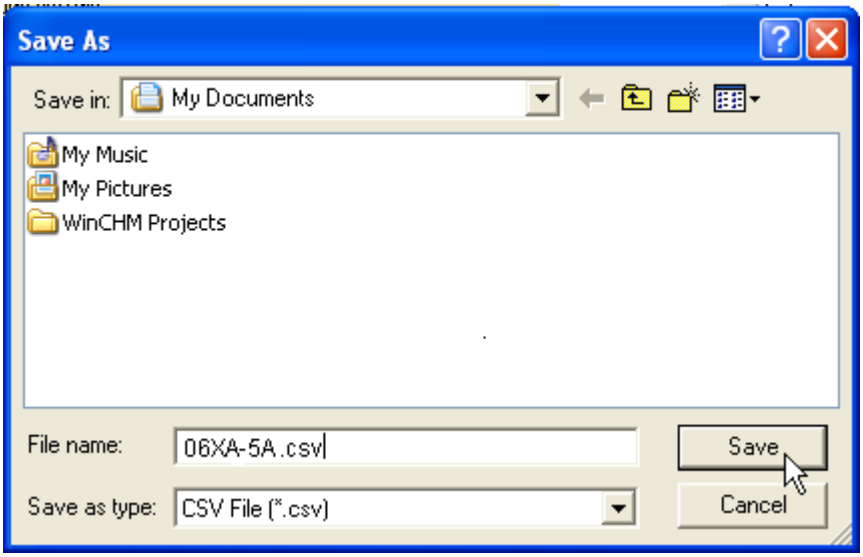
(3) If some parameters are altered, users can click **SV→PV**. The new setting values are written into the CPU module and the I/O module. If users want to read the present values in the I/O module, they can click **Update**. The present values in the I/O module are sent to ISPSoft, and are monitored.



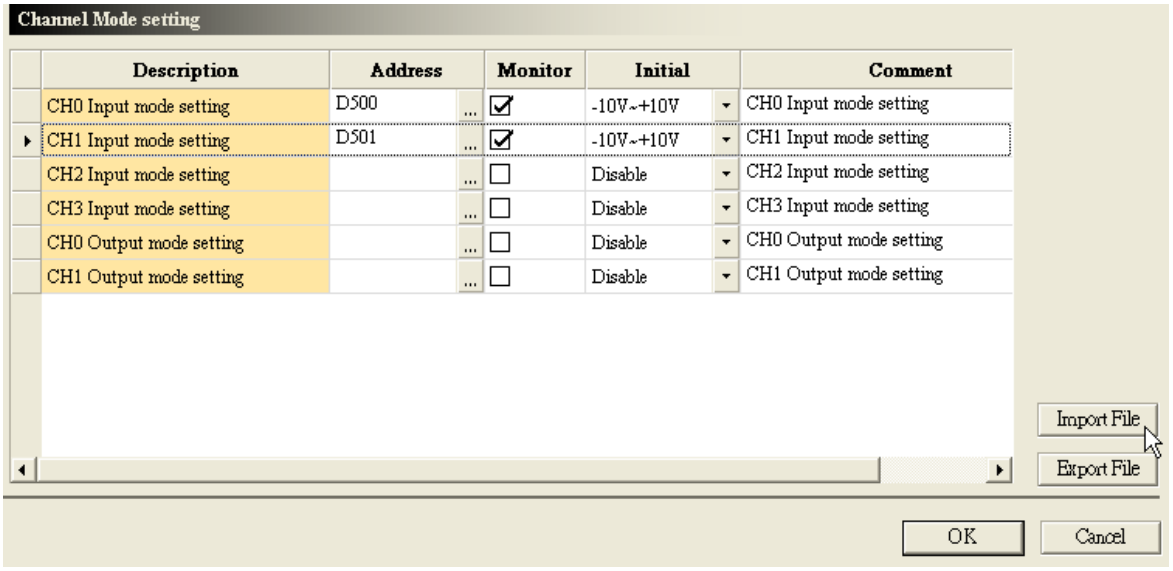
4.4.5 Importing/Exporting a Parameter File

(1) After **Export** is clicked, the parameters will be saved as a CSV file (.csv).

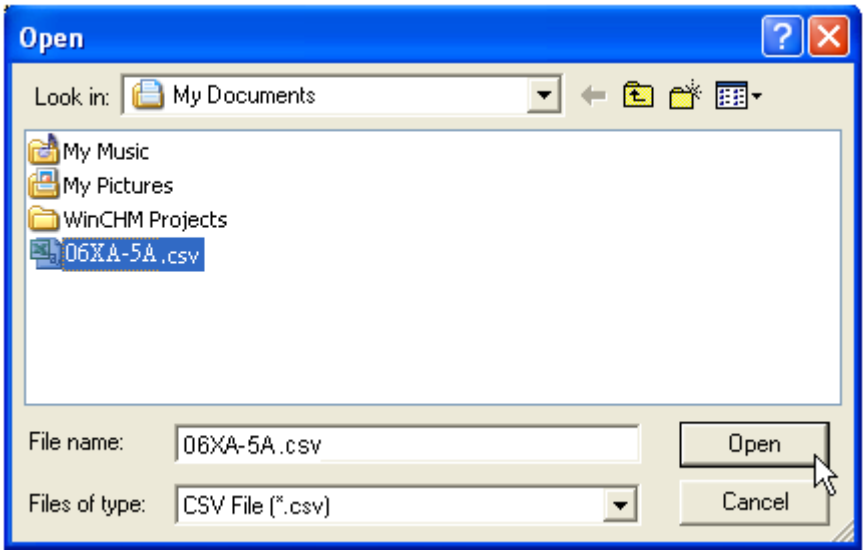




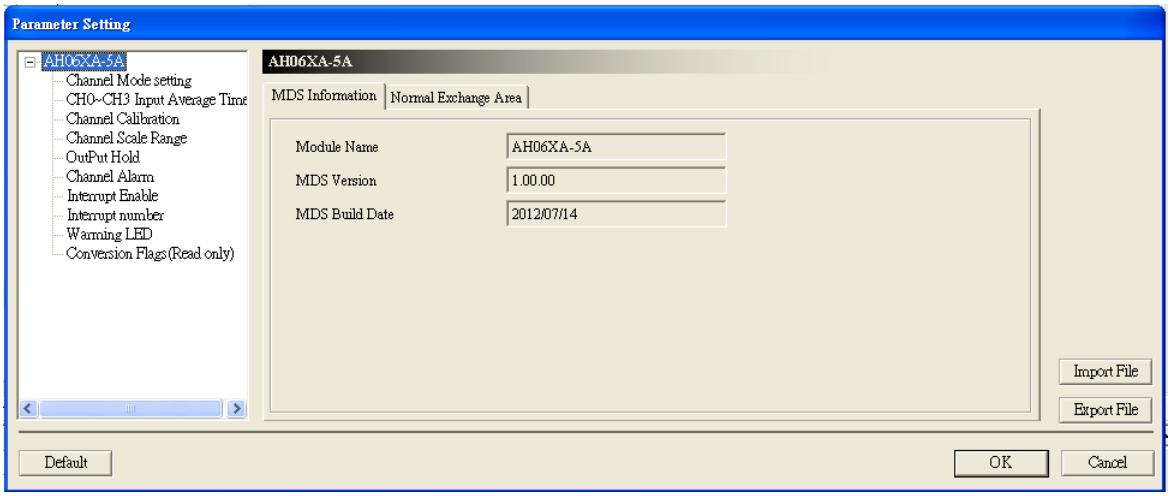
(2) Click **Import**, and then click the CSV file.



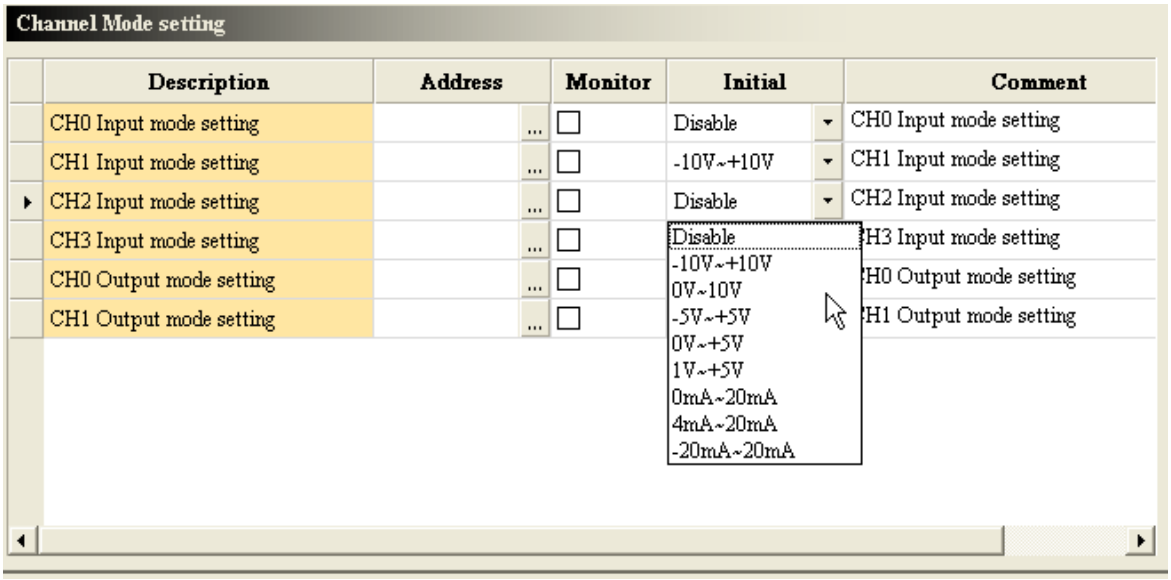
4



4.4.6 Parameters



(1) The input modes of the channels, and the output modes of the channels



AH06XA-5A	Input channel	Output channel
Description	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V 6: 0 mA ~20 mA 7: 4 mA~20 mA 8: -20 mA~20 mA	0: The channel is disabled. 1: -10 V~10 V 2: 0 V~10 V 3: -5 V~5 V 4: 0 V~5 V 5: 1 V~5 V 6: 0 mA~20 mA 7: 4 mA~20 mA

(2) The number of values averaged

CH0~CH3 Input Average Time

	Description	Address	Monitor	Initial	Comment
▸	CH0 Input Average Time	...	☐	10	CH0 Input Average Time
	CH1 Input Average Time	...	☐	10	CH1 Input Average Time
	CH2 Input Average Time	...	☐	10	CH2 Input Average Time
	CH3 Input Average Time	...	☐	10	CH3 Input Average Time

(3) The offsets and the gains used for calibration

Channel Calibration

	Description	Address	Monitor	Initial	Comment
▸	CH0 Input Cal. Offset (V/mA)	...	☐	0.000000	CH0 Input Cal. Offset (V/mA)
	CH1 Input Cal. Offset (V/mA)	...	☐	0.000000	CH1 Input Cal. Offset (V/mA)
	CH2 Input Cal. Offset (V/mA)	...	☐	0.000000	CH2 Input Cal. Offset (V/mA)
	CH3 Input Cal. Offset (V/mA)	...	☐	0.000000	CH3 Input Cal. Offset (V/mA)
	CH0 Output Cal. Offset (V/mA)	...	☐	0.000000	CH0 Output Cal. Offset (V/mA)
	CH1 Output Cal. Offset (V/mA)	...	☐	0.000000	CH1 Output Cal. Offset (V/mA)
	CH0 Input Cal. Gain	...	☐	1.000000	CH0 Input Cal. Gain
	CH1 Input Cal. Gain	...	☐	1.000000	CH1 Input Cal. Gain
	CH2 Input Cal. Gain	...	☐	1.000000	CH2 Input Cal. Gain
	CH3 Input Cal. Gain	...	☐	1.000000	CH3 Input Cal. Gain
	CH0 Output Cal. Gain	...	☐	1.000000	CH0 Output Cal. Gain

(4) The scale range

Channel Scale Range

	Description	Address	Monitor	Initial	Comment
▸	CH0 Input Scale LSP	...	☐	0.000000	CH0 Input Scale LSP
	CH1 Input Scale LSP	...	☐	0.000000	CH1 Input Scale LSP
	CH2 Input Scale LSP	...	☐	0.000000	CH2 Input Scale LSP
	CH3 Input Scale LSP	...	☐	0.000000	CH3 Input Scale LSP
	CH0 Output Scale LSP	...	☐	0.000000	CH0 Output Scale LSP
	CH1 Output Scale LSP	...	☐	0.000000	CH1 Output Scale LSP
	CH0 Input Scale HSP	...	☐	100.000000	CH0 Input Scale HSP
	CH1 Input Scale HSP	...	☐	100.000000	CH1 Input Scale HSP
	CH2 Input Scale HSP	...	☐	100.000000	CH2 Input Scale HSP
	CH3 Input Scale HSP	...	☐	100.000000	CH3 Input Scale HSP
	CH0 Output Scale HSP	...	☐	100.000000	CH0 Output Scale HSP

(5) Retaining the outputs

OutPut Hold

	Description	Address	Monitor	Initial	Comment
▸	CH0 Output Hold	...	☐	☐ Hold	CH0 Output Hold
	CH1 Output Hold		☐	☐ Hold	CH1 Output Hold

(6) The channel detection

Channel Alarm

	Description	Address	Monitor	Initial	Comment
▸	CH0 Physical Range Detect	...	☐	☑ Enable	CH0 Physical Range Detect
	CH1 Physical Range Detect		☐	☑ Enable	CH1 Physical Range Detect
	CH2 Physical Range Detect		☐	☑ Enable	CH2 Physical Range Detect
	CH3 Physical Range Detect		☐	☑ Enable	CH3 Physical Range Detect
	CH0 Detect is Alarm or warning		☐	☑ Alarm	CH0 Detect is Alarm or warning
	CH1 Detect is Alarm or warning		☐	☑ Alarm	CH1 Detect is Alarm or warning
	CH2 Detect is Alarm or warning		☐	☑ Alarm	CH2 Detect is Alarm or warning
	CH3 Detect is Alarm or warning		☐	☑ Alarm	CH3 Detect is Alarm or warning

4

(7) Enabling the interrupts

Interrupt Enable

	Description	Address	Monitor	Initial	Comment
▸	CH0 Interrupt of Over Physical Range	...	☐	☐ Enable	CH0 Interrupt of Over Physical
	CH1 Interrupt of Over Physical Range		☐	☐ Enable	CH1 Interrupt of Over Physical
	CH2 Interrupt of Over Physical Range		☐	☐ Enable	CH2 Interrupt of Over Physical
	CH3 Interrupt of Over Physical Range		☐	☐ Enable	CH3 Interrupt of Over Physical

(8) The interrupt numbers

Interrupt number

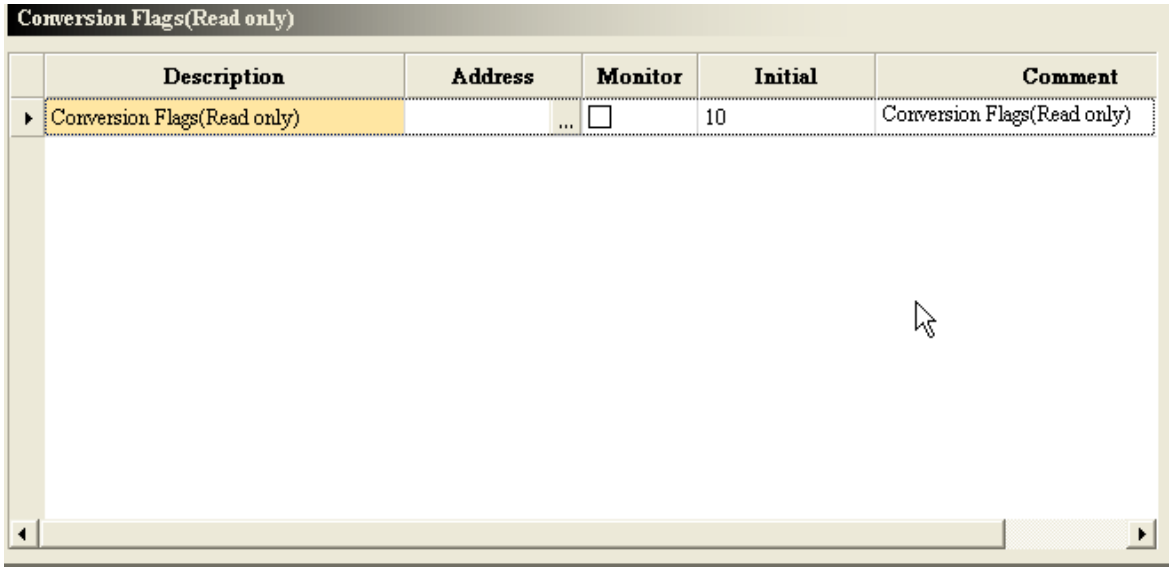
	Description	Address	Monitor	Initial	
▸	Interrupt number that CH0 input value Out of Physical Rang	...	☐	40	Interrupt nu
	Interrupt number that CH1 input value Out of Physical Rang	...	☐	40	Interrupt nu
	Interrupt number that CH2 input value Out of Physical Rang	...	☐	40	Interrupt nu
	Interrupt number that CH3 input value Out of Physical Rang	...	☐	40	Interrupt nu

(9) Setting the warning LED indicator

Warming LED

	Description	Address	Monitor	Initial	Comm
▸	Warn of CH0 Input value Out of Physical Range	...	☐	☐ flashing	Warn of CH0 Input valu
	Warn of CH1 Input value Out of Physical Range		☐	☐ flashing	Warn of CH1 Input valu
	Warn of CH2 Input value Out of Physical Range		☐	☐ flashing	Warn of CH2 Input valu
	Warn of CH3 Input value Out of Physical Range		☐	☐ flashing	Warn of CH3 Input valu

(10) The error codes



4

4.5 Troubleshooting

4.5.1 Error Codes

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A600	Alarm	Hardware failure	OFF	ON
16#A601	Alarm	The external voltage is abnormal.	OFF	ON
16#A603	Alarm	Internal error The factory correction is abnormal.	OFF	ON
16#A400	Alarm	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A401	Alarm	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A402	Alarm	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A403	Alarm	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A000	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A001	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A002	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A003	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	Blink

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A800	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A801	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A802	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A803	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	OFF

4.5.2 Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.
The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.
Internal error The factory correction is abnormal.	Please contact the factory.
The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 0.
The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 3.

MEMO

Chapter 5 Temperature Measurement Module AH04PT-5A

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5.1 Overview

The specifications for a temperature measurement module, the operation, and the programming are described in this chapter. AH04PT-5A is a temperature measurement module. It converts temperatures received from a platinum sensor into digital signals. Users can select the degree Celsius or the degree Fahrenheit as a unit of measurement for temperature.

5.1.1 Characteristics

(1) **A sensor is selected according to practical application.**
Pt100/Ni100/Pt1000/Ni1000 sensor

(2) **High-speed conversion**
Two-wire/Four-wire configuration: 150 ms/channel
Three-wire configuration: 300 ms/channel

(3) **High accuracy**
Conversion accuracy: The error is ±0.5% of an input. (The ambient temperature is 25±5°C.)

(4) **Disconnection detection**
When a sensor is disconnected, AH04PT-5A gives an alarm or a warning.

(5) **PID control**
An object can be maintained at a desired temperature through a PID control action.

(6) **A module can be set by means of utility software.**
HWCONFIG is built-in utility software in ISPSoft. Users can set modes and parameters in HWCONFIG to complete hardware configuration without spending time writing a program to set registers corresponding to functions.

5

5.2 Specifications and Functions

5.2.1 Specifications

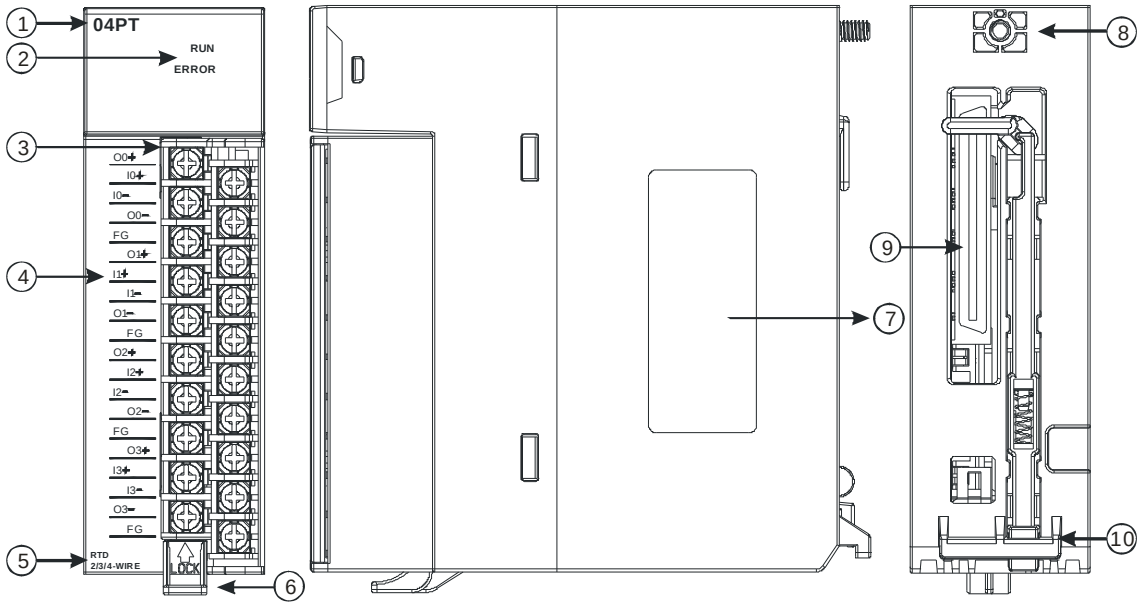
Electrical specifications

Number of analog inputs	4
Applicable sensor	Three-wire configuration: Pt100/Ni100/Pt1000/Ni1000 sensor, and 0~300 Ω input impedance Two-wire/Four-wire configuration: Pt100/Ni100/Pt1000/Ni1000 sensor, and 0~300 Ω input impedance Pt100: DIN 43760-1980 JIS C1604-1989; 100 Ω 3850 PPM/°C Pt1000: DIN EN60751; 1 kΩ 3850 PPM/°C Ni100/Ni1000: DIN 43760
Supply voltage	24 V DC (20.4 V DC~28.8 V DC) (-15%~+20%)
Connector type	Removable terminal block
Overall accuracy	25°C/77°F: The error is ±0.5% of the input within the range -20~60°C/-4~140°F: The error is ±1% of the input within the range
Conversion time	Two-wire/Four-wire Four-wire configuration: 150 ms/channel Three-wire configuration: 300 ms/channel
Isolation	There is isolation between a digital circuit and an analog circuit, and there is isolation between analog channels. Isolation between a digital circuit and a ground: 500 V DC Isolation between an analog circuit and a ground: 500 V DC Isolation between an analog circuit and a digital circuit: 500 V DC Isolation between the 24 V DC and a ground: 500 V DC

Functional specifications

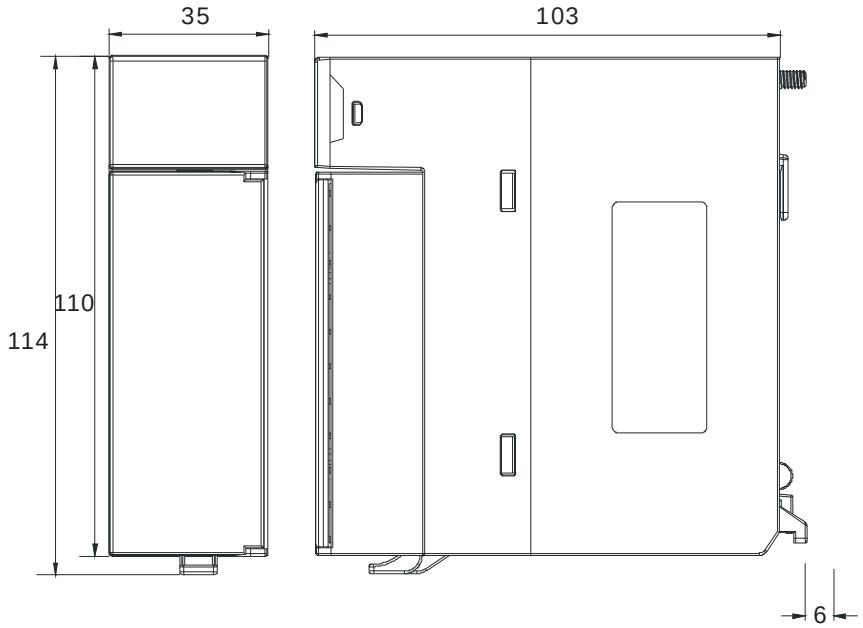
Analog-to-digital conversion	Centigrade (°C)	Fahrenheit (°F)	Input impedance
Rated input range	Pt100: -180°C~800°C Ni100: -80°C~170°C Pt1000: -180°C~800°C Ni1000: -80°C~170°C	Pt100: -292°F~1,472°F Ni100: -112°F~338°F Pt1000: -292°F~1,472°F Ni1000: -112°F~338°F	0~300 Ω
Average function	Range: 1~100		
Self-diagnosis	Disconnection detection		

5.2.2 Profile



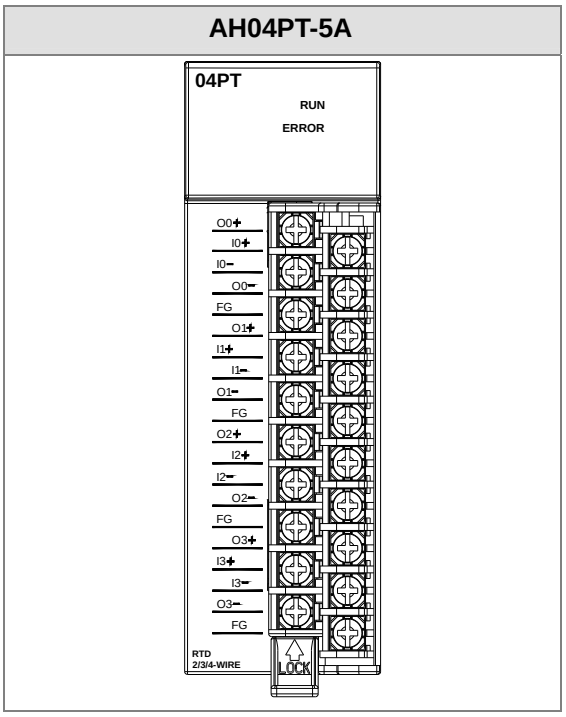
Number	Name	Description
1	Model name	Model name of the module
2	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.
3	Removable terminal block	The inputs are connected to sensors.
4	Arrangement of the input terminals	Arrangement of the terminals
5	Description of the inputs	Simple specifications for the module
6	Clip	Removing the terminal block
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

5.2.3 Dimensions



Unit: mm

5.2.4 Arrangement of Terminals



5.2.5 Functions

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Temperature unit	Users can select the degree Celsius (°C) or the degree Fahrenheit (°F) as a unit of measurement for temperature.
3	Calibration	Users can calibrate a linear curve.
4	Average	Conversion values are averaged and filtered.
5	Disconnection detection	When a sensor is disconnected, AH04PT-5A gives an alarm or a warning.
6	Channel detection	If an input signal exceeds a range of inputs which can be received by hardware, the module will give an alarm or a warning. a. Warning LED indicator: When a warning occurs, the ERROR LED indicator blinks or does not blink. b. Interrupt: An interrupt service routine is enabled.
7	PID control	An object can be maintained at a desired temperature through a PID control action.

1. Enabling/Disabling a channel

A temperature received from a two-wire/four-wire sensor is converted into a digital value at a speed of 150 ms a channel, and a temperature received from a three-wire sensor is converted into a digital value at a speed of 300 ms a channel. If a channel is not used, users can disable it to decrease the total conversion time.

2. Temperature unit

Users can select the degree Celsius (°C) or the degree Fahrenheit (°F) as a unit of measurement for temperature.

3. Calibration

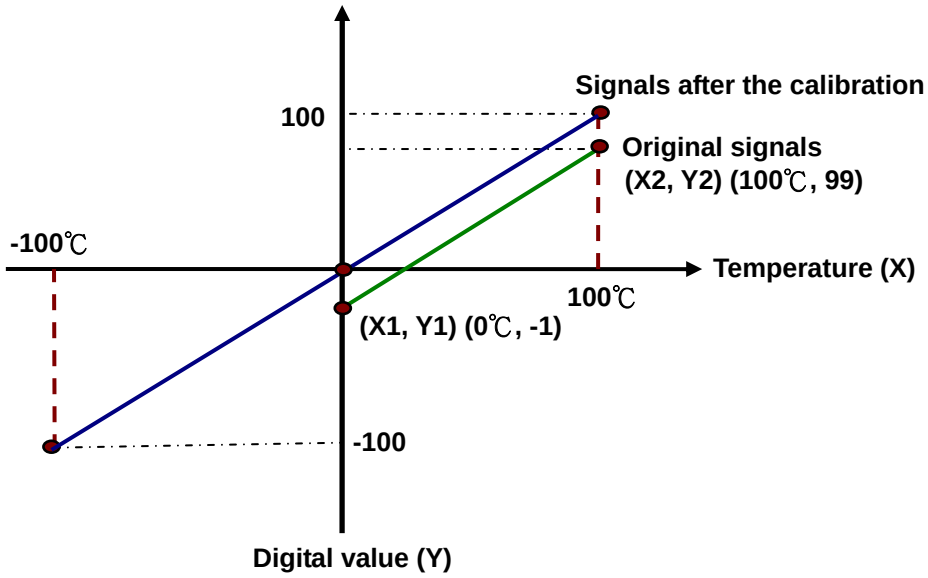
- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of inputs which can be received by hardware.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

Example 1:

The temperatures -100℃~100℃ correspond to the digital values -100~100. The original signals are used. The gain is 1, and the offset is 0. The temperature received by the channel is 0℃, and the digital value is -1. The temperature received by the channel is 100℃, and the digital value is 99. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[99-(-1)]/(100-0)=1
Gain used for calibration=1/Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=-1
Offset used for calibration=1-Y1=1



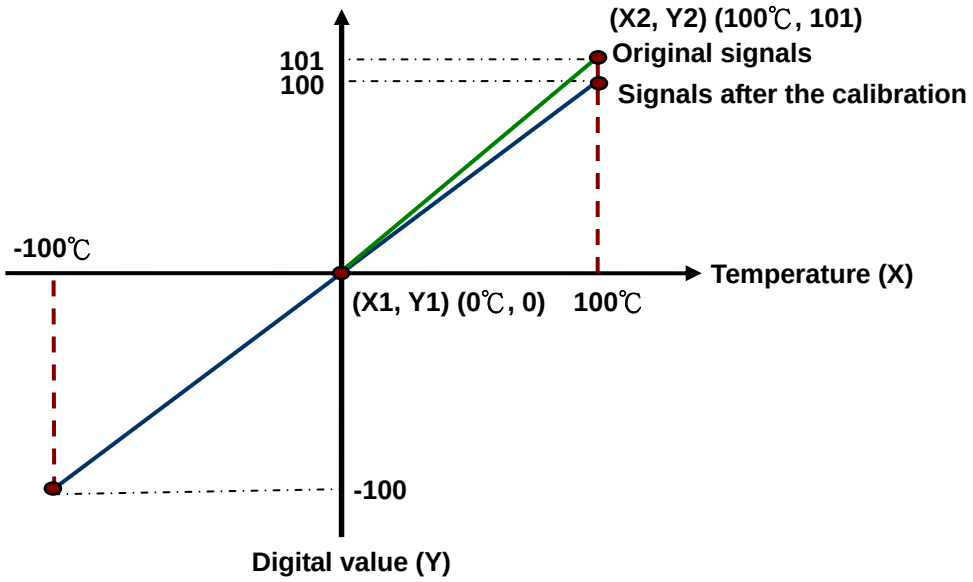
(X: Temperature; Y: Digital value)

Example 2:

The temperatures -100℃~100℃ correspond to the digital values -100~100. The original signals are used. The gain is 1, and the offset is 0. The temperature received by the channel is 0℃, and the digital value is 0. The temperature received by the channel is 100℃, and the digital value is 101. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[101-0]/(100-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



(X: Temperature; Y: Digital value)

4. Average

Digital values are averaged. The number by which the sum of several digital values is divided is between 1 and 100. The sampled values are taken as a queue, and the length of the queue is N. Each time a new sampled value is put at the end of the queue, an original value at the start of the queue is removed. The N values are averaged so that the periodic noise is suppressed.

5. Disconnection detection

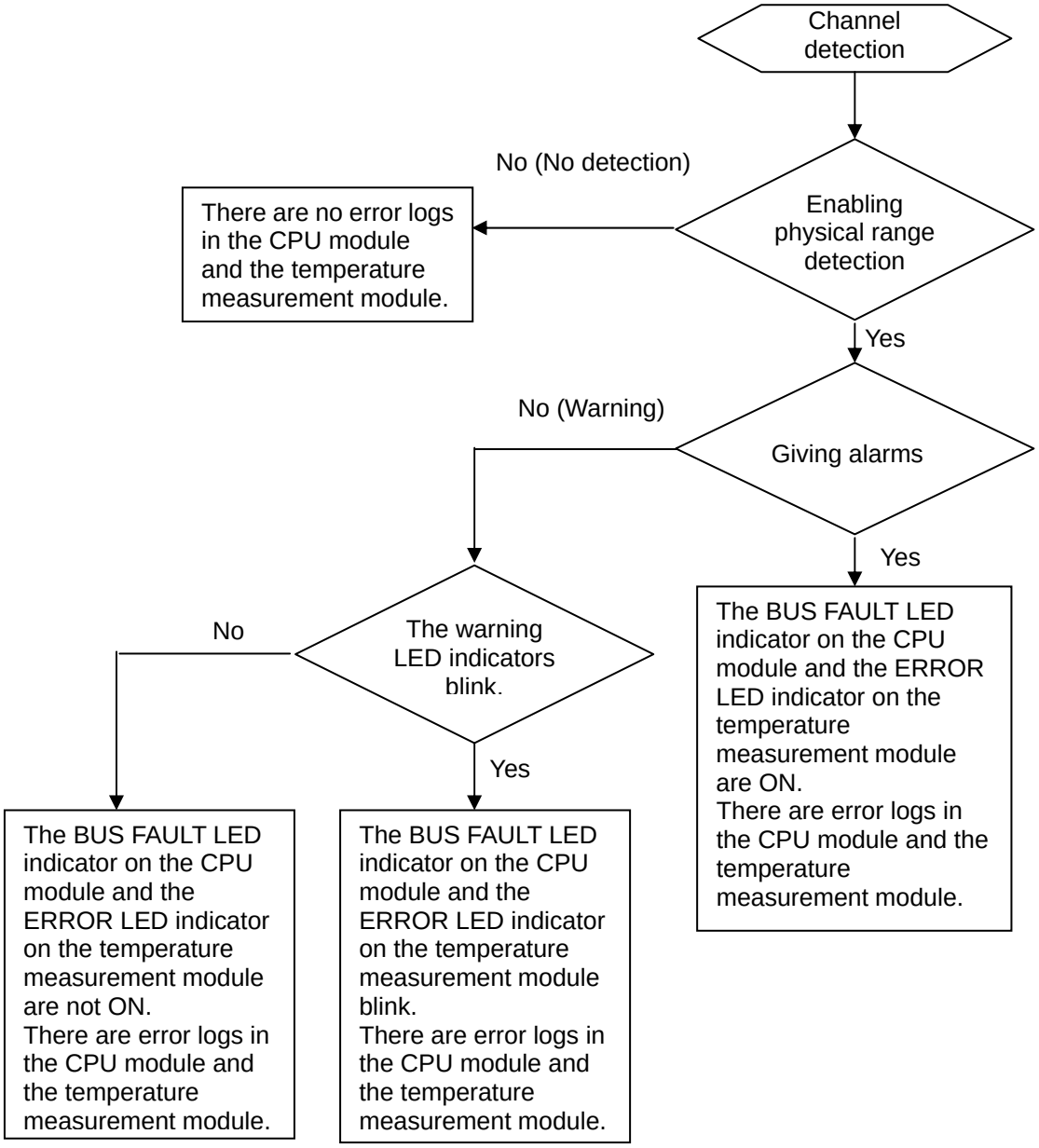
If a channel is enabled, the module will check whether a sensor is disconnected. If an input circuit is an open circuit, the module will give an alarm. Please refer to description below for more information.

6. Channel detection

If an input signal exceeds a range of inputs which can be received by hardware, an error message appears. Please refer to section 5.2.1 for more information.

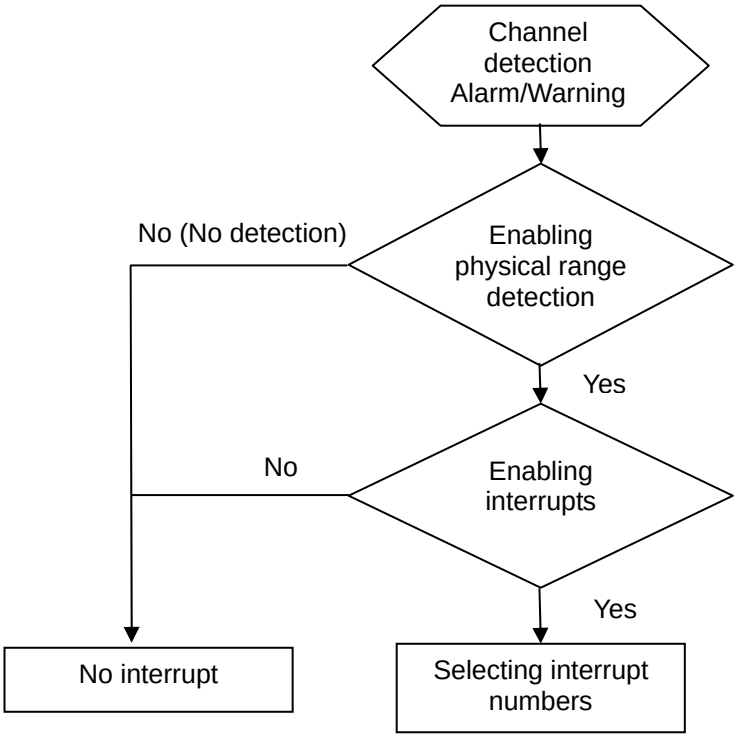
a. Giving alarms or warnings

The procedure below explains how to set a module so that it gives an alarm or a warning.


Channel detection
Enabling physical range detection
No (No detection)
There are no error logs in the CPU module and the temperature measurement module.
Yes
Giving alarms
No (Warning)
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module are ON.
There are error logs in the CPU module and the temperature measurement module.
The warning LED indicators blink.
No
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module are not ON.
There are error logs in the CPU module and the temperature measurement module.
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module blink.
There are error logs in the CPU module and the temperature measurement module.

b. Interrupt service routine

The procedure below explains how to trigger an interrupt service routine in a CPU module.



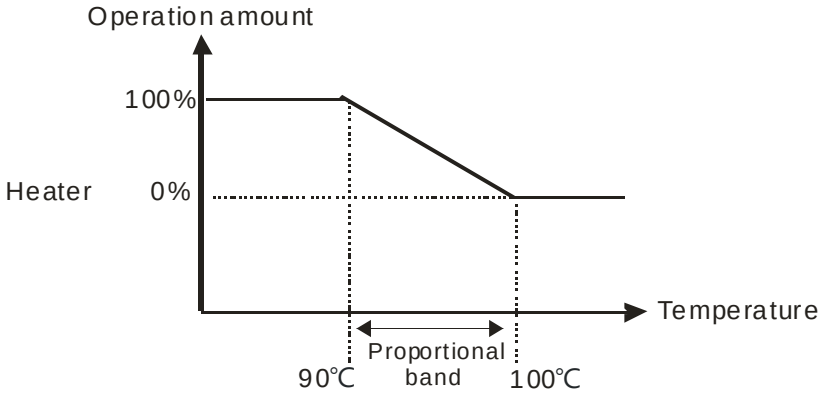
- The interrupt service routines are I40~I251.

7. PID control

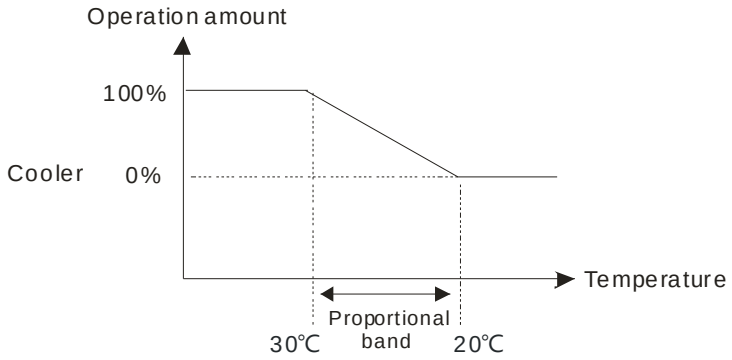
a. KP/KI/KD

Proportional action: The operation amount acts proportionally to the error. When a temperature is lower than a proportional band, the operation amount is 100%. When a temperature is within a proportional band, the operation amount decreases proportionally to the error. When the setting value is the same as the present value, the operation amount is 0%. (Error=Setting value–Present value)

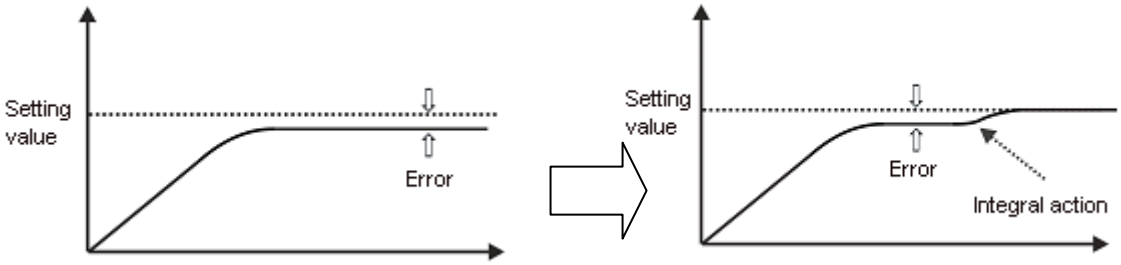
Heater: The setting value is 1000 (100°C), and K_P is 100 (10°C). The relation between the temperature and the operation amount is shown below.



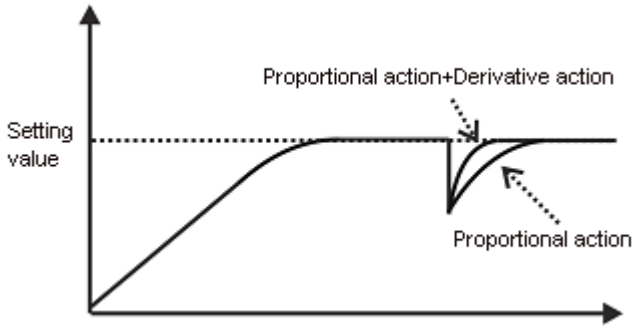
Cooler: The setting value is 200 (20°C), and KP is 100 (10°C). The relation between the temperature and the operation amount is shown below.



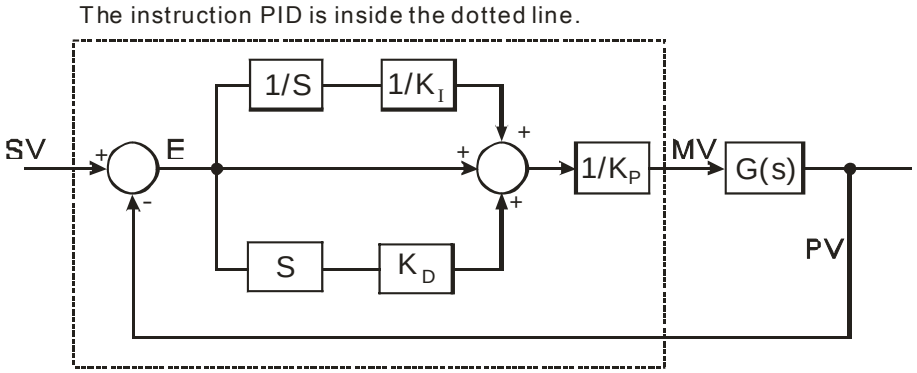
Integral action: If temperature is controlled by a pure proportional action, there is difference between the temperature controlled and a setting value. Therefore, if an integral action is used with a proportional action, difference decreases as time goes by, and the temperature controlled is the same as the setting value.



Derivative action: With regard to violent environmental change, a derivative action provides more operation amount to make temperature return to its original controlled state.



Control diagram:



The PID algorithm is as follows.

$$MV = K_P E(t) + K_I \int_0^t E(t)dt + K_D * \frac{dE(t)}{dt}$$

Forward action: $E(t) = PV(t) - SV(t)$

Reverse action: $E(t) = SV(t) - PV(t)$

b. Control mode

Cyclic control mode: Users set a cycle according to a controlled environment. (If the ambient air temperature changes slowly, the cycle can be longer.)

The width of a pulse is defined below.

- Pulse width=Output value (MV)/(Maximal output value–Minimal output value)×Cycle

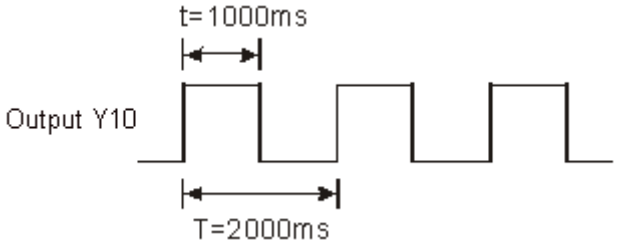
Users can set the width of a pulse and a cycle (sampling time) by means of the instruction GPWM.

Example:

The cycle is 2000 ms, the maximal output value is 100, and the minimal output value is 0. After the PID algorithm is performed, the output value gotten is 50.

- Width of a pulse=50/(100-0)×2000 ms=1000 ms

Therefore, the pulse width used in the instruction GPWM is 1000 ms, and the cycle used in the instruction GPWM is 2000 ms.



c. PID parameters

PID parameter		Description
Performing/Not performing the PID algorithm		bit0~bit3: CH0~CH3 (Performing/Not performing the PID algorithm) bit8~bit11: CH0~CH3 (Manual/Automatic tuning)
Manual/Automatic tuning		
Heating/Cooling mode		bit0~bit3: CH0~CH3
Sampling time		One-word decimal format Unit: 10 ms
Automatic mode	Automatic tuning	bit0~bit3: CH0~CH3
	Refreshing the manual output values automatically	bit0~bit3: CH0~CH3
	Target value	One-double word floating-point format
	Proportional gain	One-double word floating-point format
	Integral gain	One-double word floating-point format
	Derivative gain	One-double word floating-point format
	Range within which the error values are count as 0	One-double word floating-point format When the setting value is 0, the function is not enabled. For example, if the setting value is 5, and the difference between the present value and the target value is in the range of -5 to 5, the output value is 0.
	Maximum output value	One-double word floating-point format
	Minimum output value	One-double word floating-point format
	Reading the output value	One-double word floating-point format
	Accumulated integral value	One-double word floating-point format
Manual mode	Manual output value	One-double word floating-point format

d. Additional remarks on PID control

(1) If K_p, K_i, or K_d is 0, the corresponding function is disabled. For example, if users only want to use proportional control, K_i and K_d are 0.

(2) If users do not know how to adjust the parameters K_p, K_i, and K_d under a controlled environment, they can use the automatic tuning function to set the parameters, and then finely adjust the parameters to the optimum values. When the automatic tuning function is enabled, the value in a register defined by the users is 1. After the automatic tuning of the parameters is complete, the value in the register becomes 0.

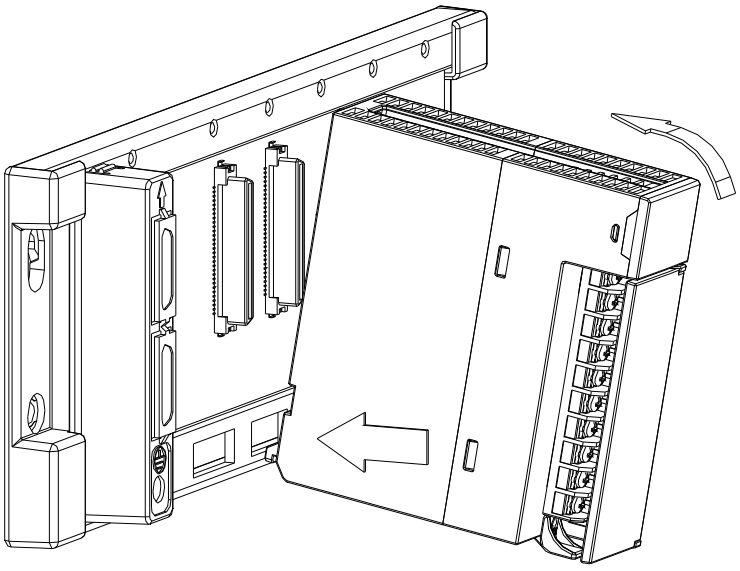
(3) If users want to set the parameters K_p, K_i, and K_d by themselves, they need to set the K_p by experience, and set the K_i, and K_d to 0. After the tuning of the K_p is complete, the users can tune the K_i, and K_d in order.

5.3 Installation

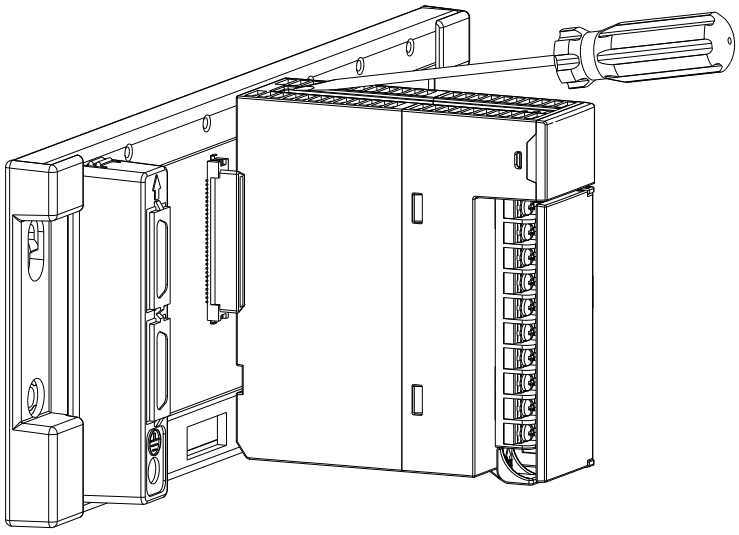
5.3.1 Installing a Module

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.

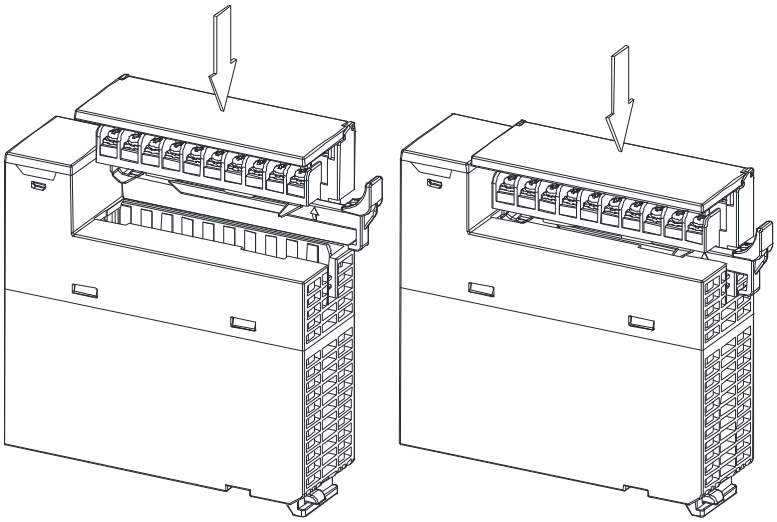


3. Tighten the screw on the module.

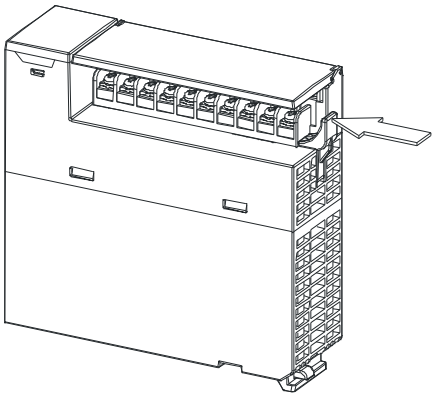


5.3.2 Installing a Removable Terminal Block

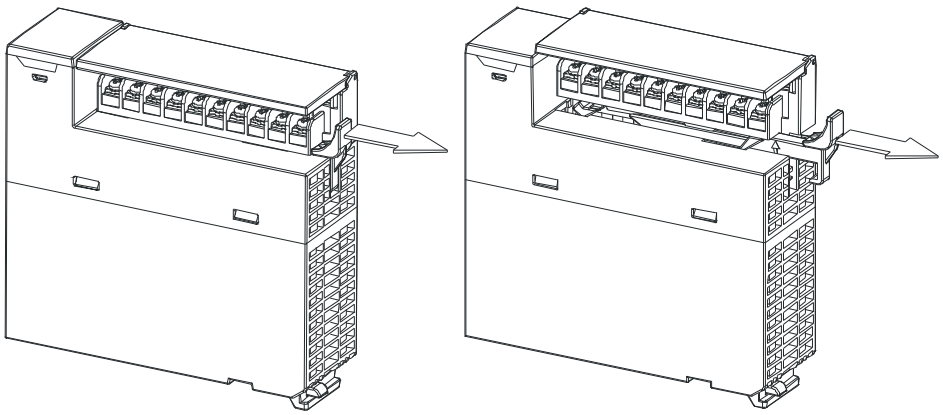
- **Installation**
  1. Level a terminal block at the printed circuit board, and press it into the module.



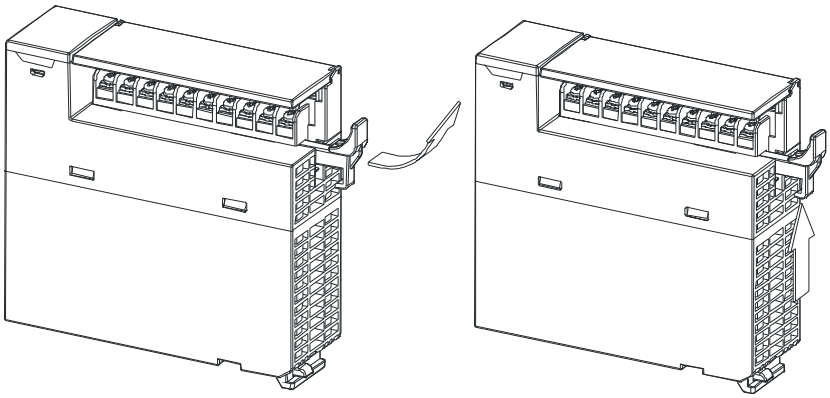
  2. Press the clip in the direction indicated by the arrow.



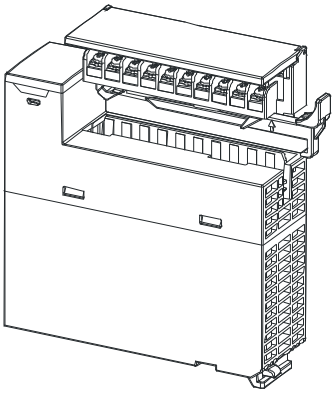
- **Removal**
  1. Pull the clip in the direction indicated by the arrow.



2. Pull up the clip.



3. The terminal block is removed.



5.3.3 Wiring

- **Precautions**

  In order to make the functions of a temperature measurement module perfect and ensure the reliability of a system at the same time, external wiring which prevents noise is necessary. Before installing cables, users need to follow the precautions below.

  (1) To prevent a surge and induction, an AC cable and input signal cables which are connected to AH04PT-5A must be separate cables.

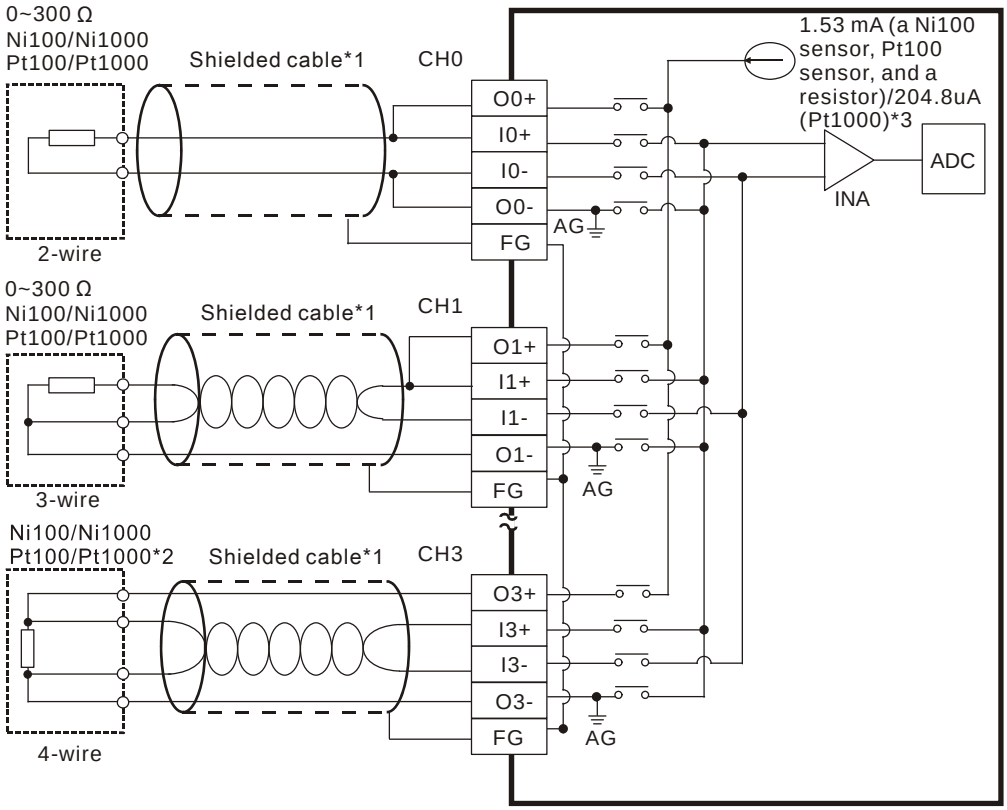
  (2) A cable must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Besides, a cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Otherwise, effects that noise, induction, and a surge have will increase.

  (3) Please connect a shielded cable and a hermetically sealed cable with the ground separately.

  (4) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.

- **External wiring**

(1) AH04PT-5A



*1. The cables or the shielded twisted pair cables for Ni100/Ni1000/Pt100/Pt1000 temperature sensors are used, and should be kept separate from other power cables and cables which generate noise. Please use a three-wire temperature sensor. If users want to use a two-wire temperature sensor, O**n**+ and I**n**+ have to be short-circuited, and O**n**- and I**n**- have to be short-circuited. (**n** is in the range of 0 to 3.)

*2. If users want to measure the resistance in the range of 0 Ω to 300 Ω, they can use a two-wire or three-wire sensor instead of a four-wire sensor.

*3. User need to select an appropriate sensor. If a Ni100 temperature sensor, a Pt100 sensor, and a resistance sensor are used, the internal excitation current is 1.53 mA. If a Ni1000 temperature sensor, and a Pt1000 temperature sensor are used, the internal excitation current is 204.8 μA.

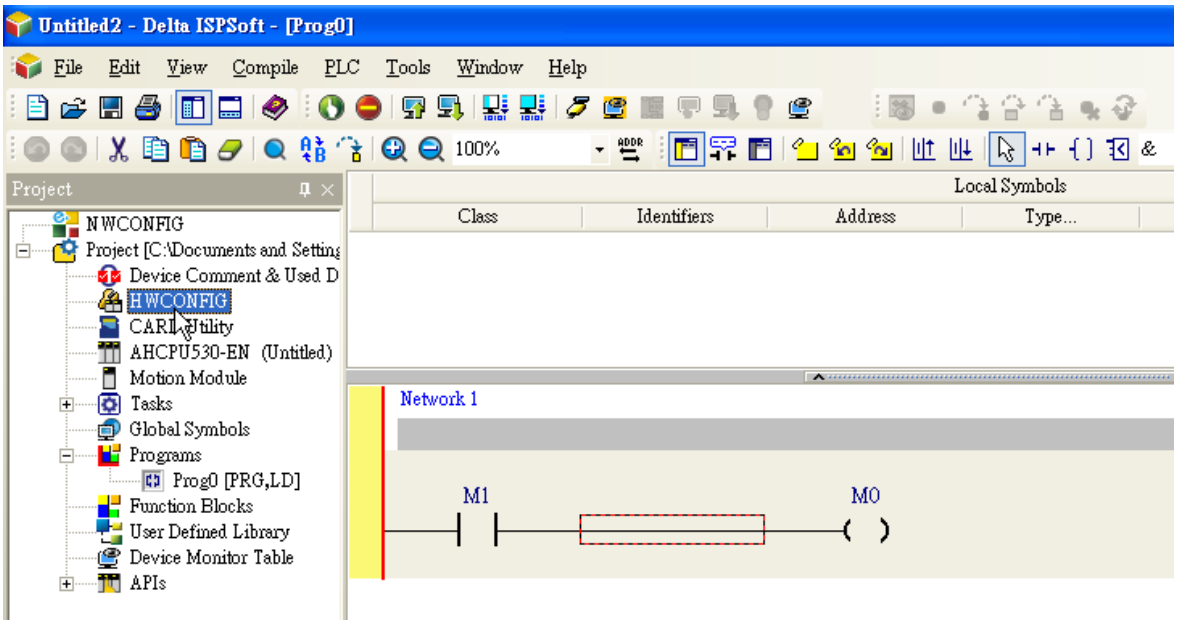
5.3.4 LED Indicators

Number	Name	Description
1	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
2	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.

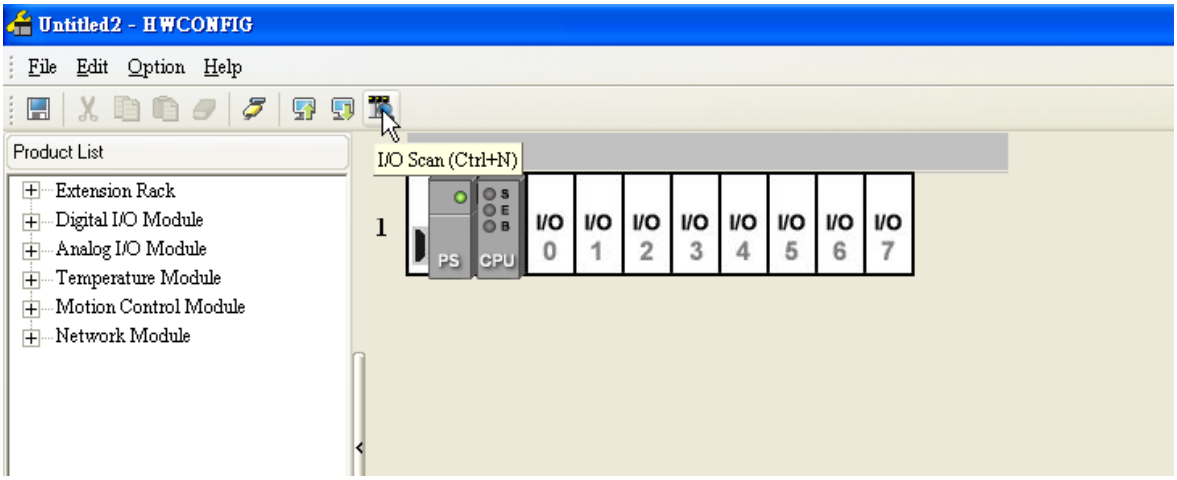
5.4 HWCONFIG in ISPSoft

5.4.1 Initial Setting

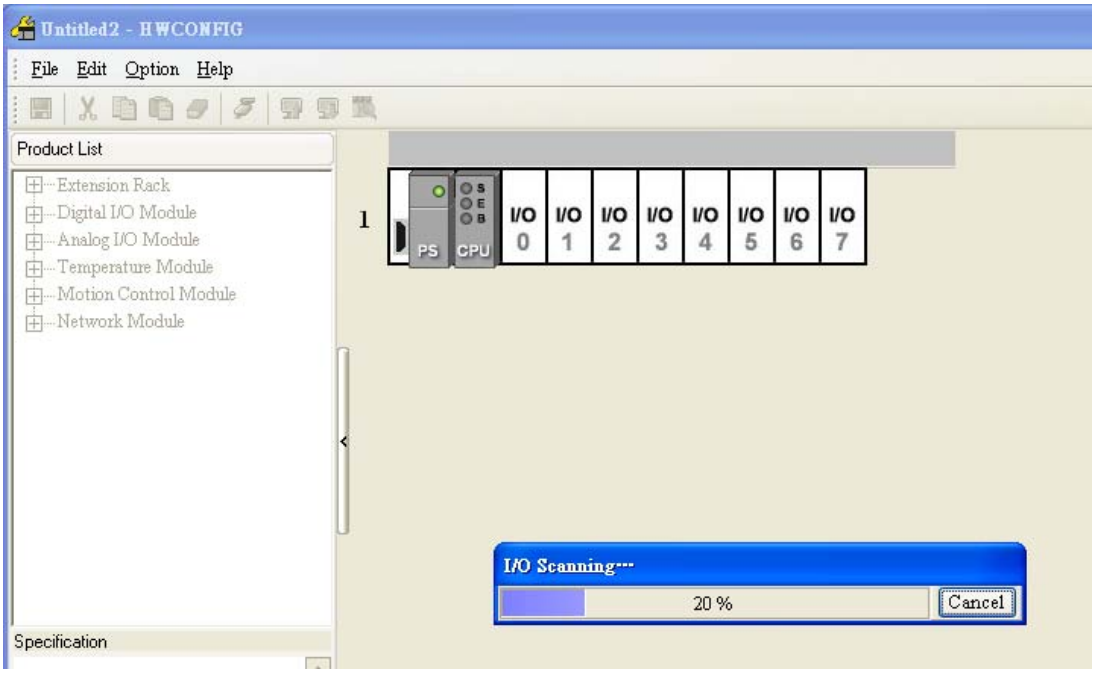
(1) Start ISPSoft, and then double-click **HWCONFIG**.



(2) Click **I/O scan** on the toolbar.



(3) ISPSoft is scanning the actual hardware configuration.



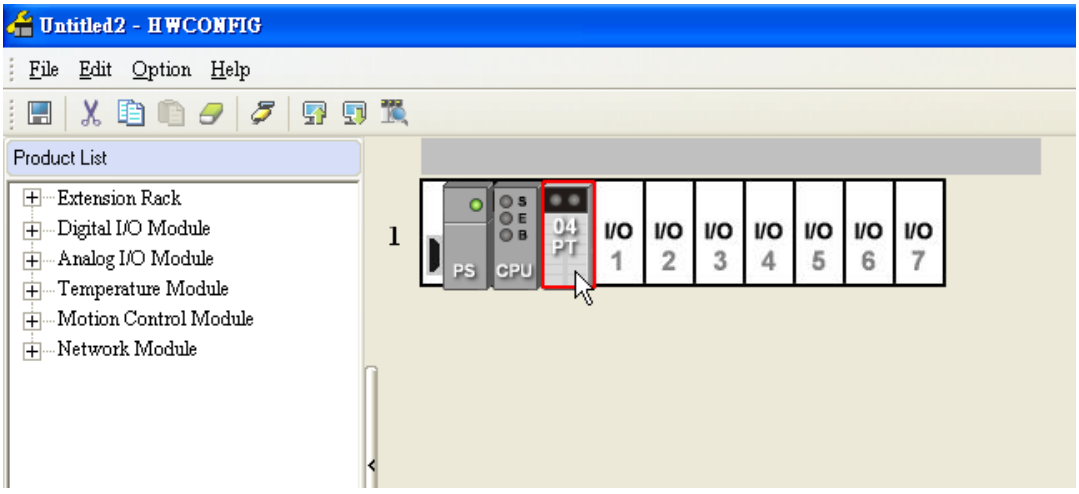
(4) After the scan of the actual hardware configuration is complete, the system automatically assigns the corresponding registers to the channels. Users can alter the input device range by themselves.

Note: Owing to the fact that values are floating-point numbers, every channel occupies two 16-bit registers.

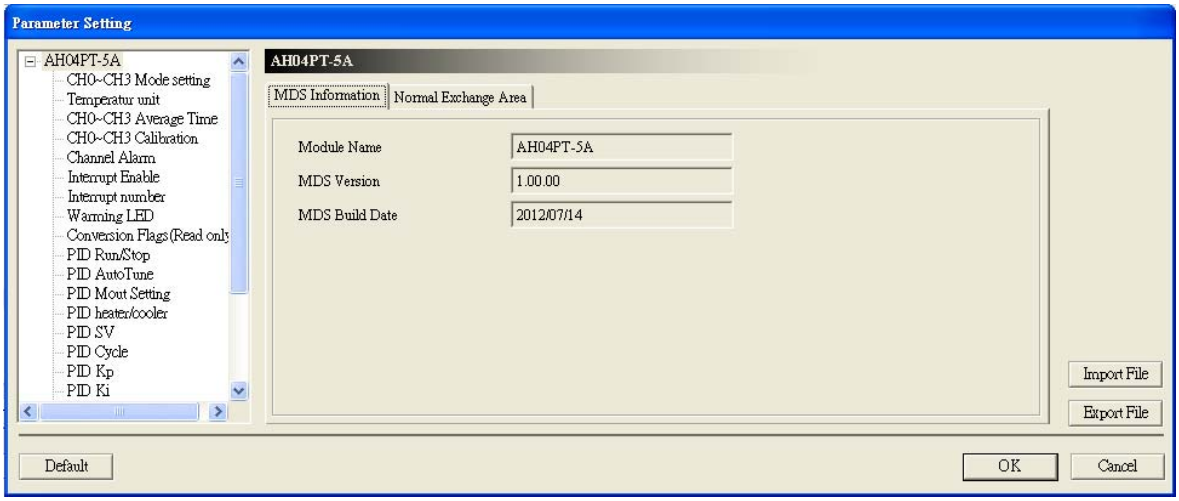
Information: Rack 1

Slot No.	Label	Firmware Versi...	Description	Input Device Ra...	Output Device R...
-	AHPS05-5A	-	AH Power Supply	None	None
-	AHCPU530-EI	1.00	Basic CPU module	None	None
0	AH04PT-5A	1.00	4 x 3/4 wires RTD i	D0 ~ D7	
1					

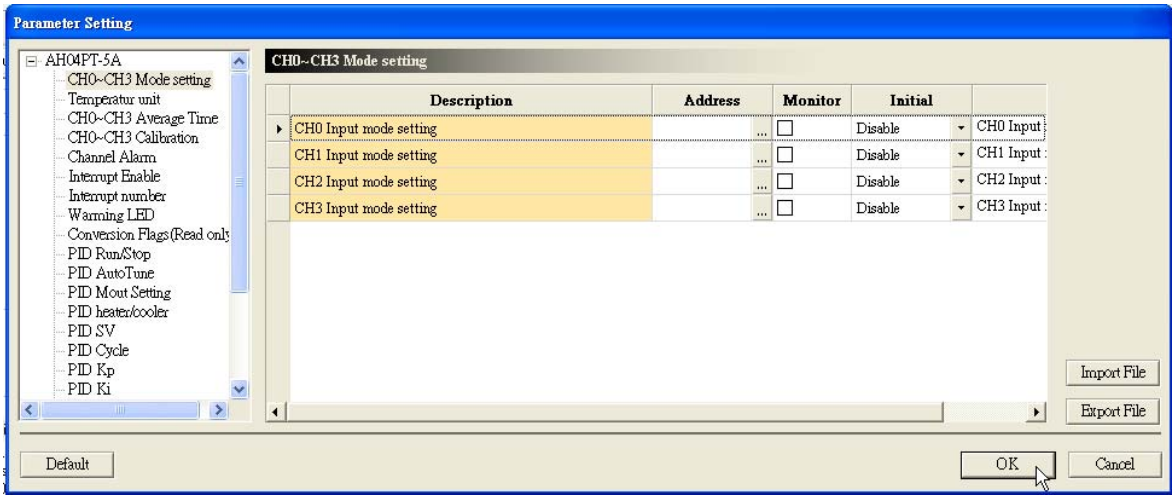
(5) Double-click the module AH04PT-5A.



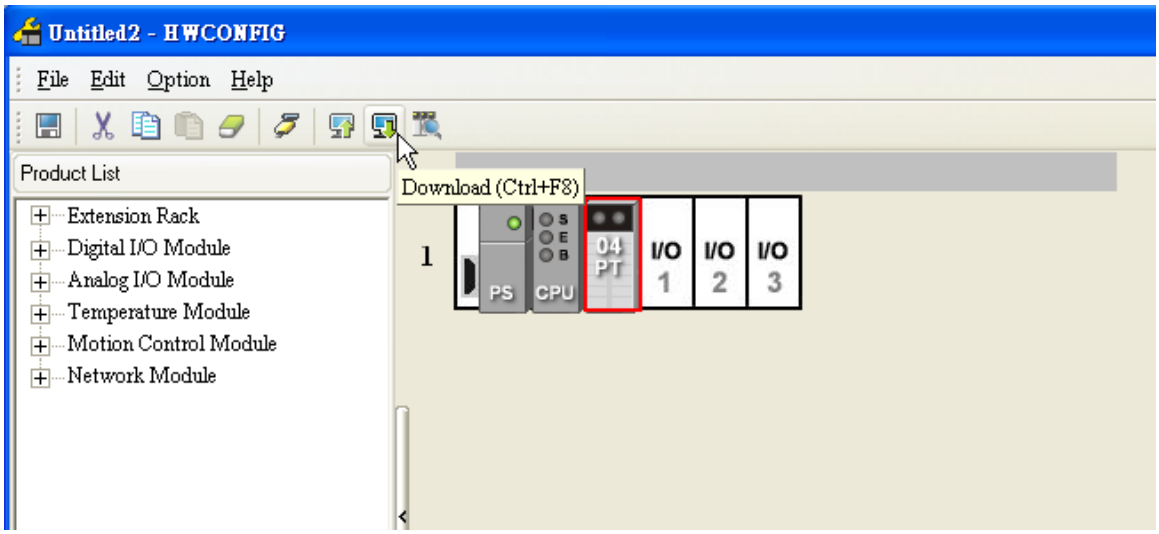
(6) Open the **Parameter Setting** window.



(7) Set the parameters, and then click **OK**.

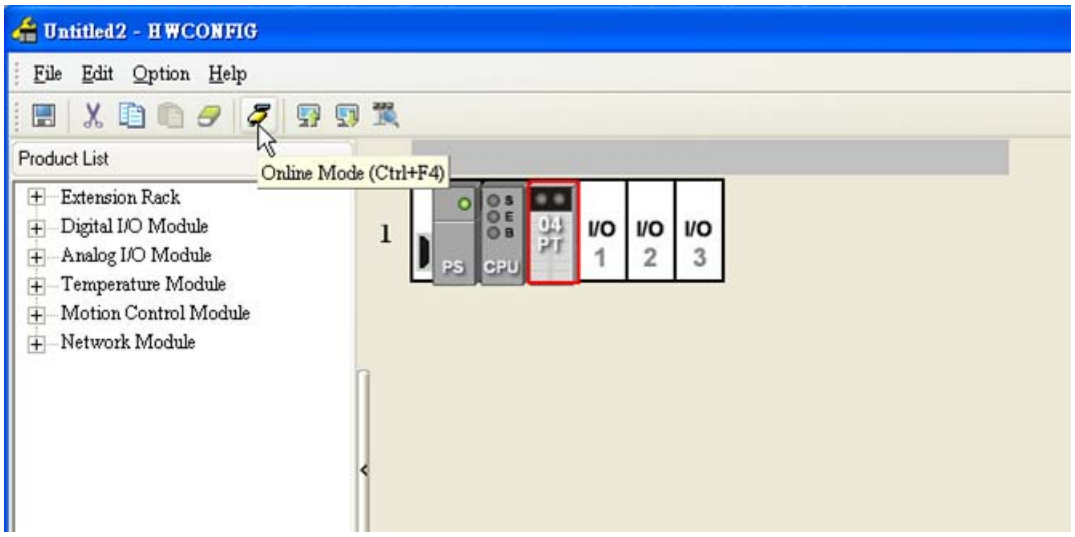


(8) Click **Download** on the toolbar to download the parameters. (The parameters can not be downloaded when the CPU module runs.)

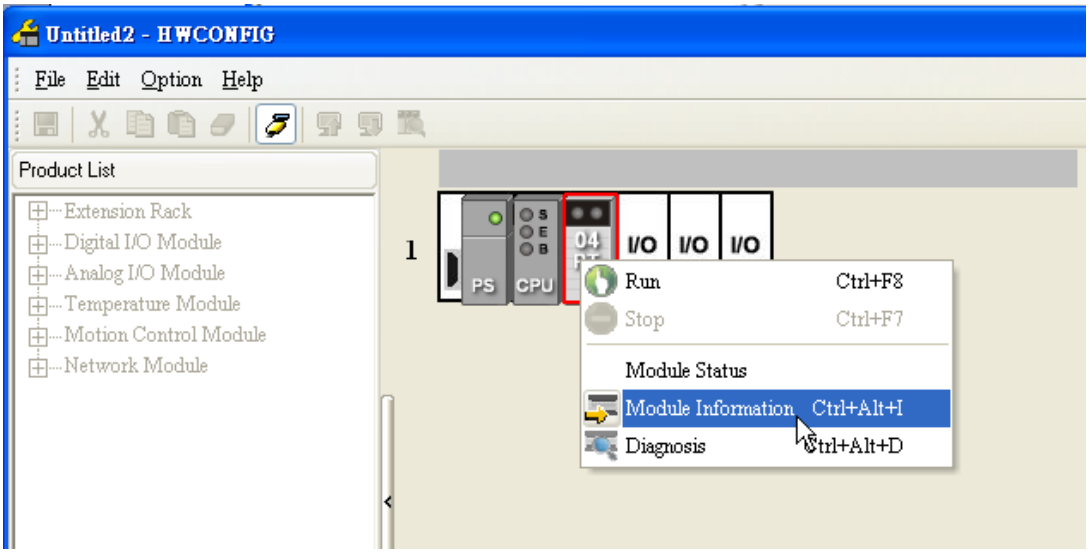


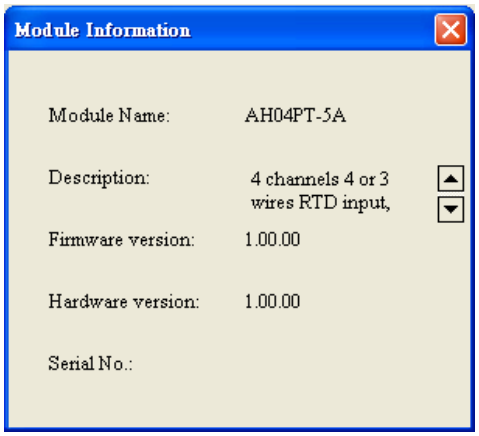
5.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



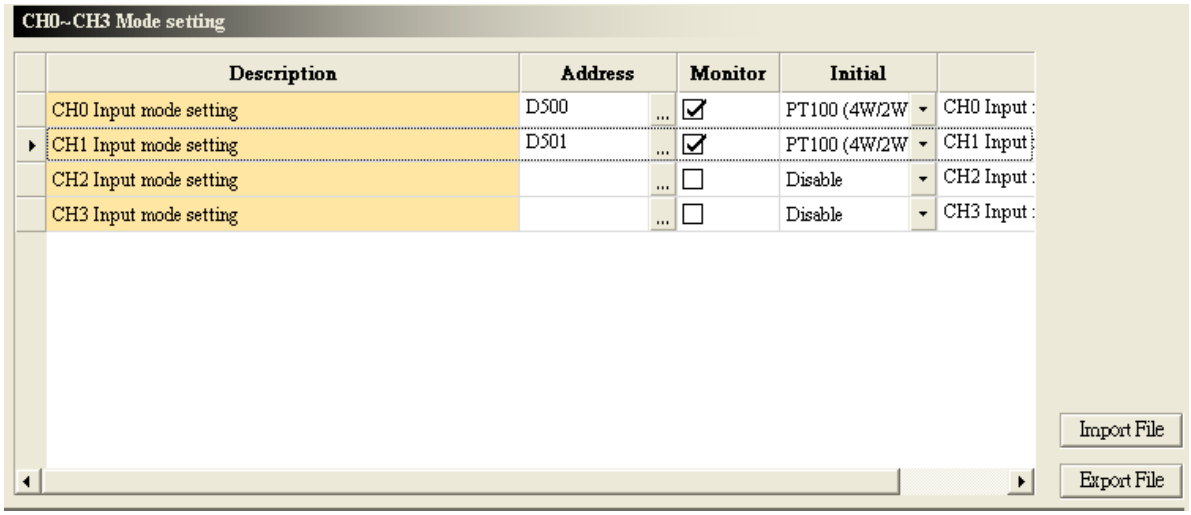
(2) Right-click the module, and then click **Module Information** on the context menu. The version of the firmware and that of the hardware are displayed.



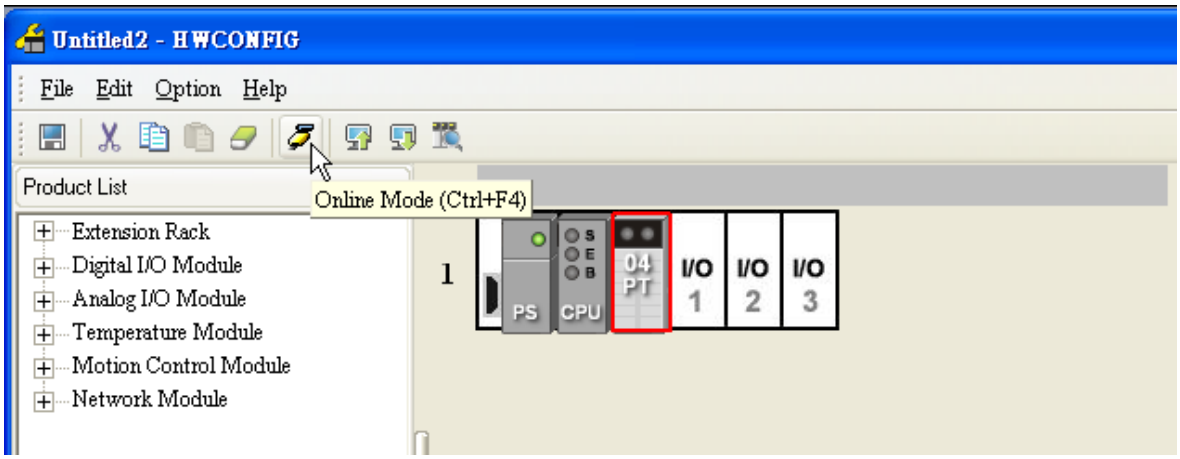


5.4.3 Monitoring Table

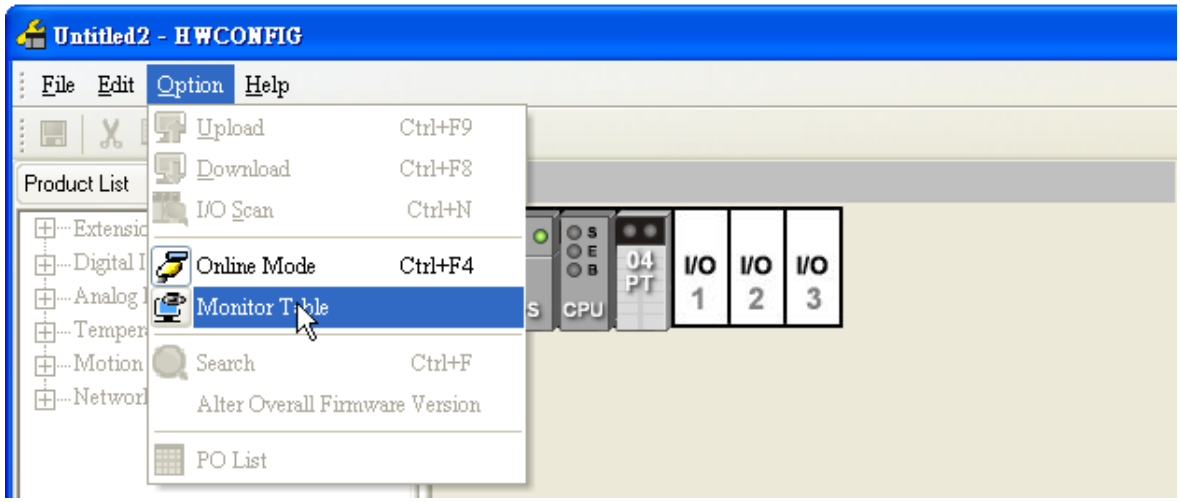
(1) Select the **Monitor** checkboxes at the right sides of the corresponding registers.

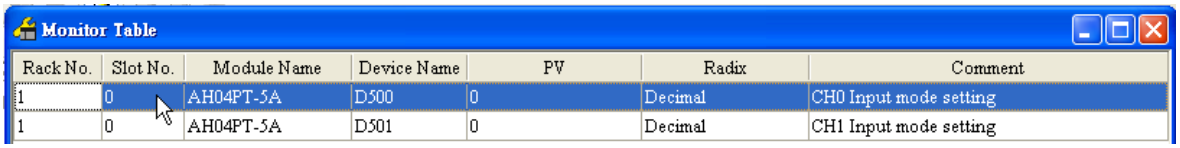


(2) On the **Option** menu, click **Online Mode**.



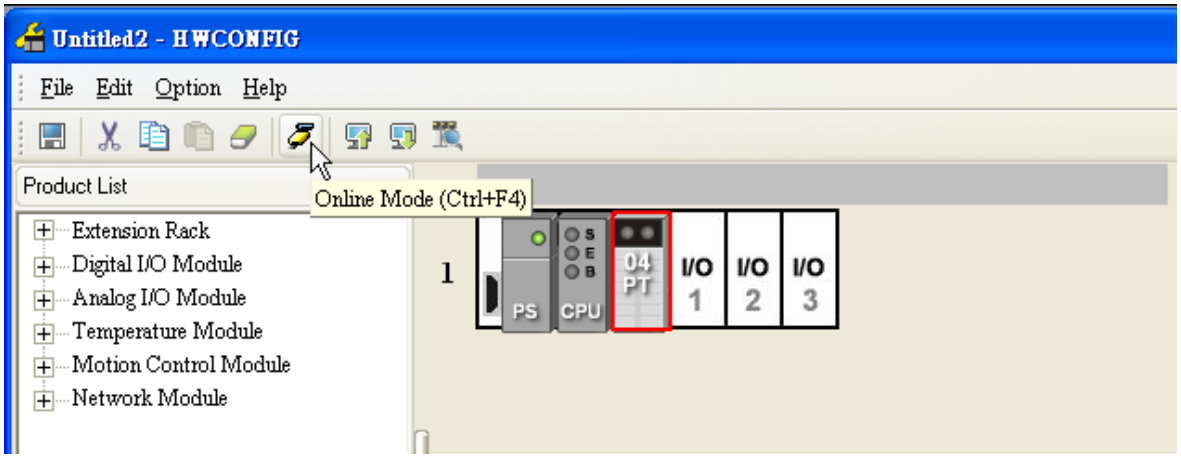
(3) On the **Option** menu, click **Monitor Table**. The registers are monitored.



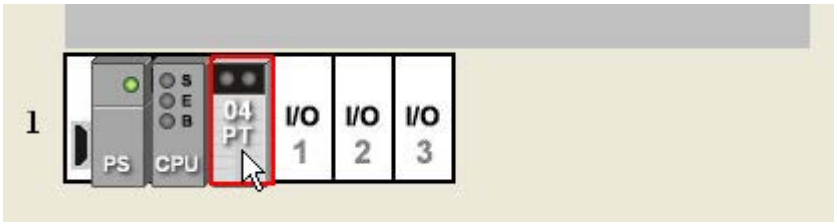

Monitor Table
Rack No. | Slot No. | Module Name | Device Name | PV | Radix | Comment
1 | 0 | AH04PT-5A | D500 | 0 | Decimal | CH0 Input mode setting
1 | 0 | AH04PT-5A | D501 | 0 | Decimal | CH1 Input mode setting

5.4.4 Online Mode

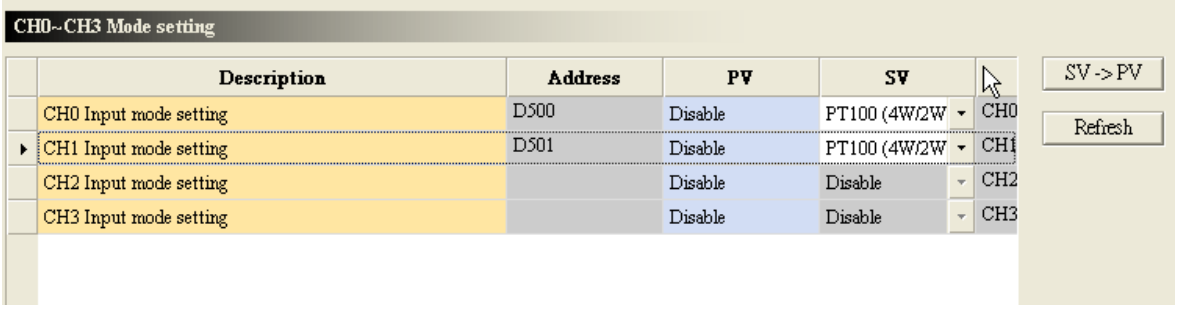
(1) Click **Online Mode** on the toolbar.



(2) Double-click the module AH04PT-5A.

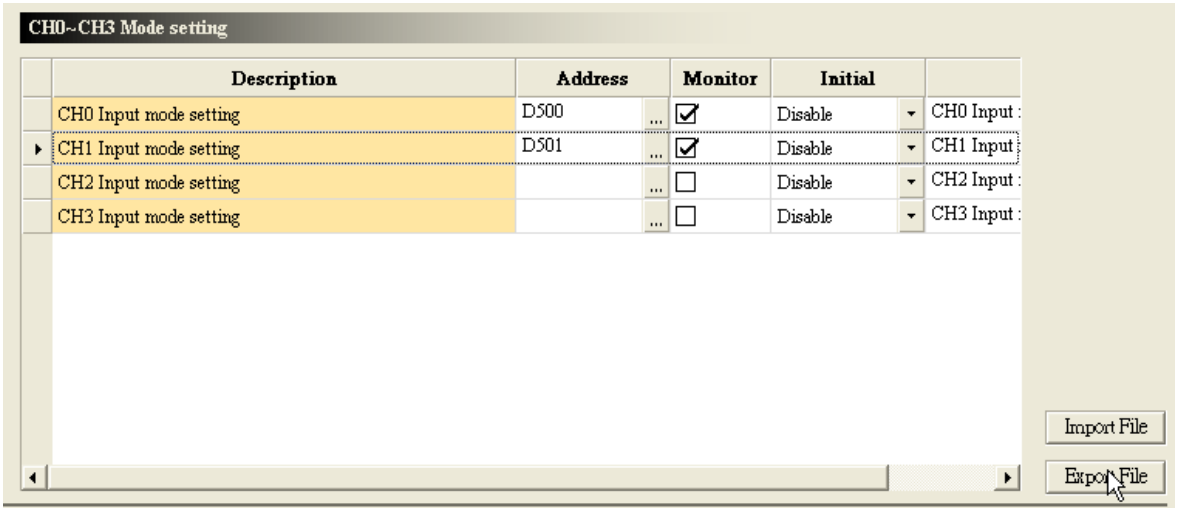


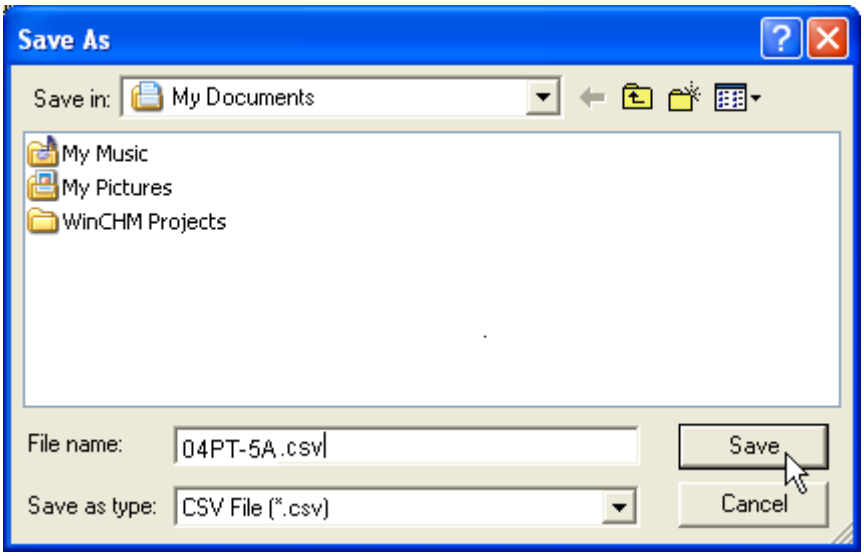
(3) If some parameters are altered, users can click **SV→PV**. The new setting values are written into the CPU module and the I/O module. If users want to read the present values in the I/O module, they can click **Update**. The present values in the I/O module are sent to ISPSoft, and are monitored.


CH0~CH3 Mode setting
Description | Address | PV | SV
CH0 Input mode setting | D500 | Disable | PT100 (4W/2W
CH1 Input mode setting | D501 | Disable | PT100 (4W/2W
CH2 Input mode setting | | Disable | Disable
CH3 Input mode setting | | Disable | Disable
SV -> PV
Refresh

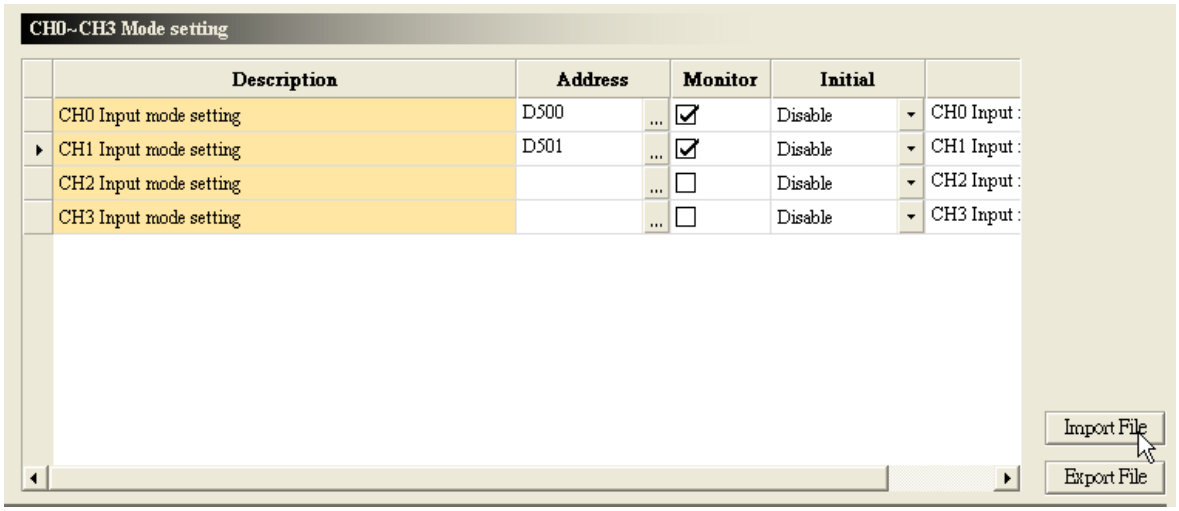
5.4.5 Importing/Exporting a Parameter File

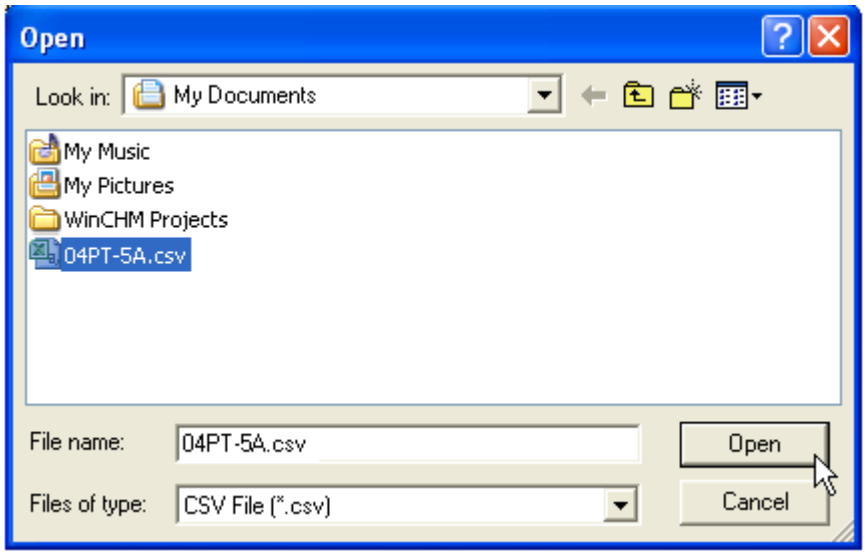
(1) After **Export** is clicked, the parameters will be saved as a CSV file (.csv).





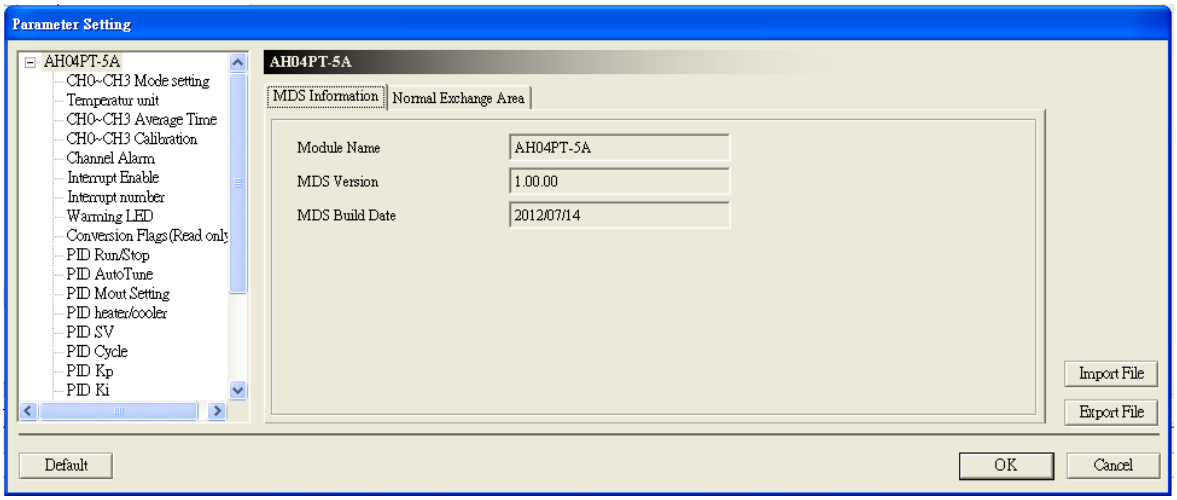
(2) Click **Import**, and then click the CSV file.



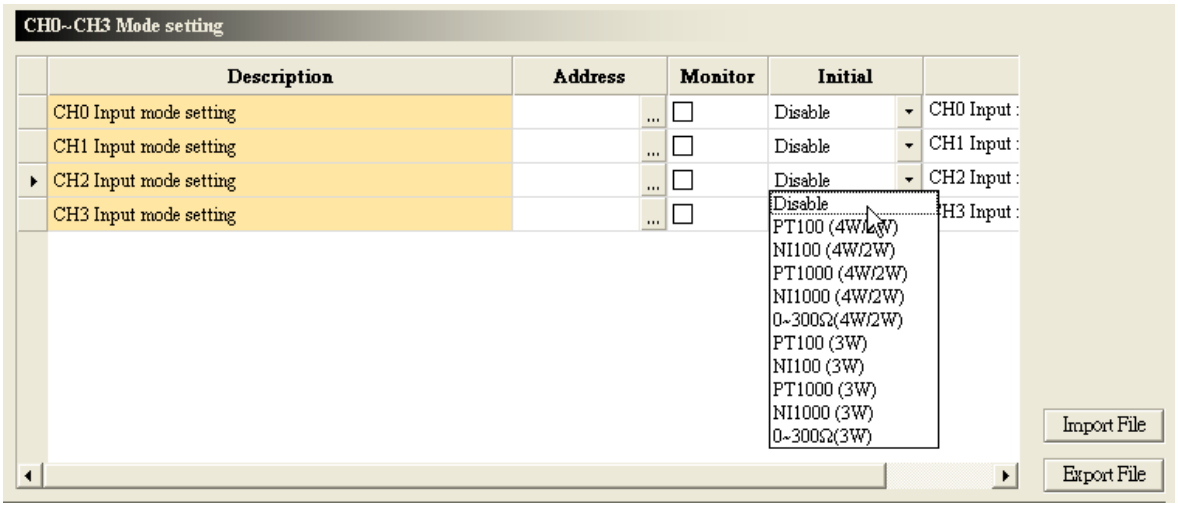


5

5.4.6 Parameters

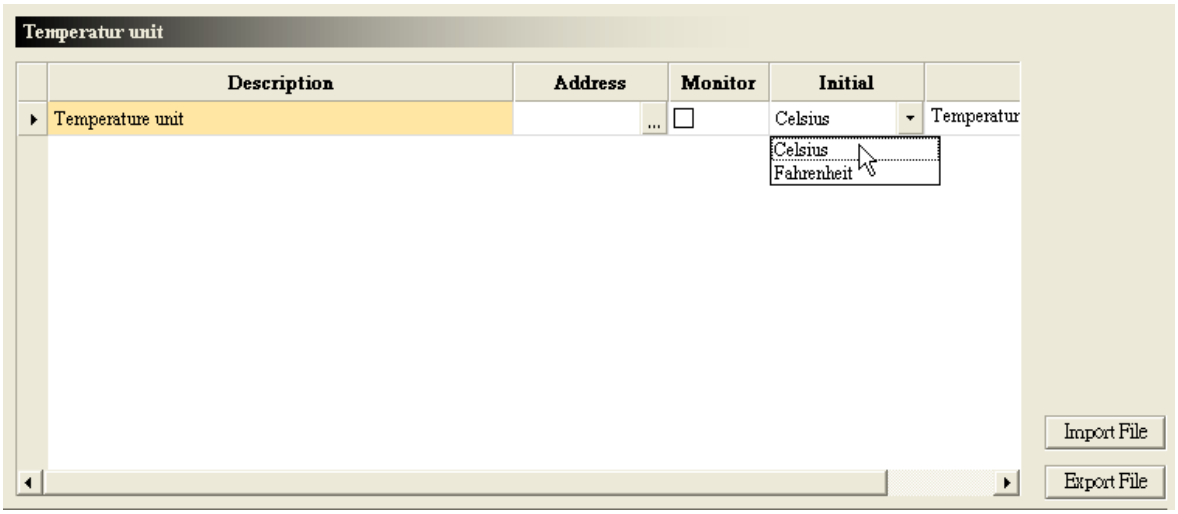


(1) The input modes of the channels



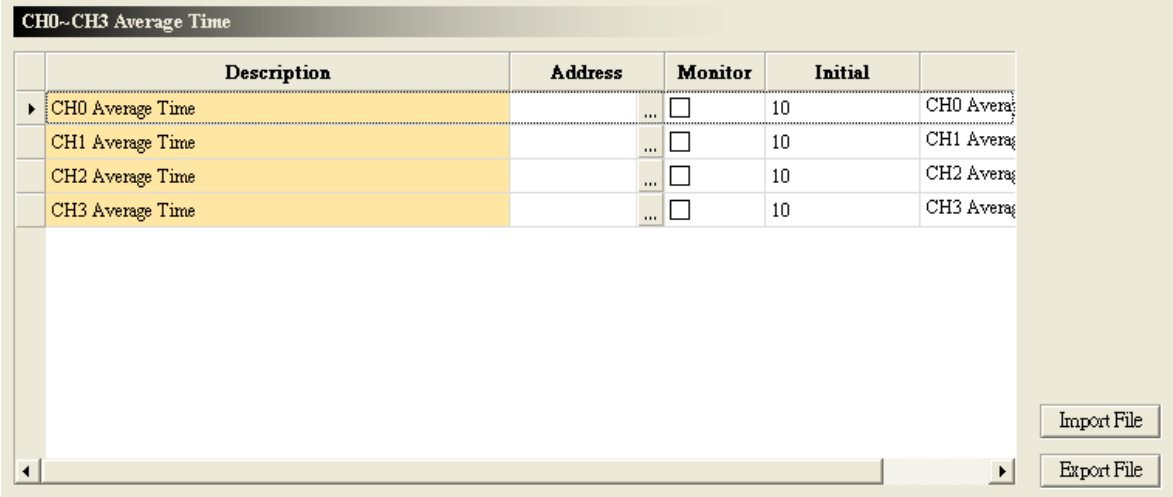
Description	0: The channel is disabled. 1: Pt100 sensor (Four-wire/Two wire configuration) 2: Ni100 sensor (Four-wire/Two wire configuration) 3: Pt1000 sensor (Four-wire/Two wire configuration) 4: Ni1000 sensor (Four-wire/Two wire configuration) 5: 0~300 Ω input impedance (Four-wire/Two wire configuration)	6: Pt100 sensor (Three-wire configuration) 7: Ni100 sensor (Three-wire configuration) 8: Pt1000 sensor (Three-wire configuration) 9: Ni1000 sensor (Three-wire configuration) 10: 0~300 Ω input impedance (Three-wire configuration)

(2) Temperature unit (Celsius/Fahrenheit)

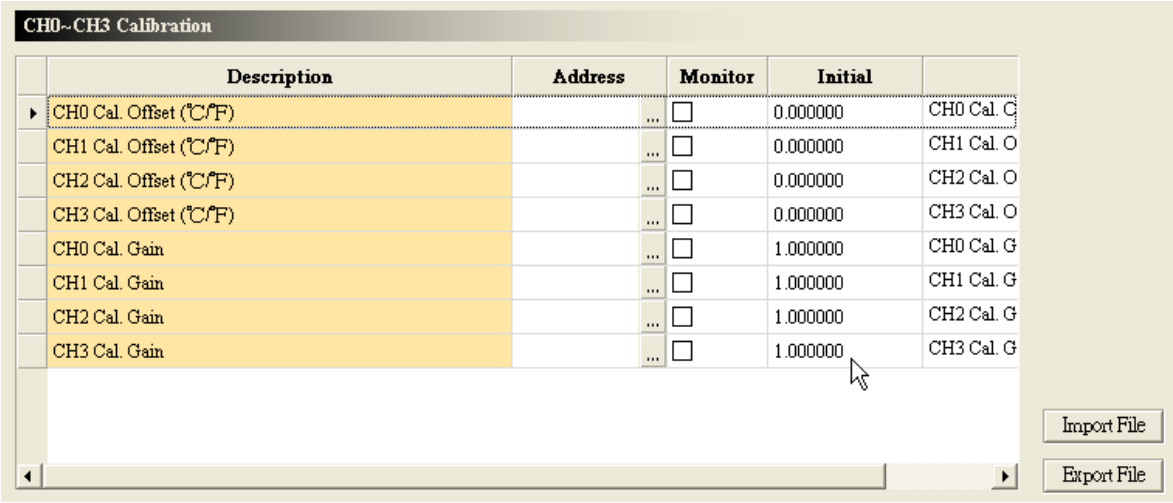


Description	K0: Celsius K1: Fahrenheit

(3) The number of values averaged



(4) The offsets and the gains used for calibration



(5) The channel detection

Channel Alarm

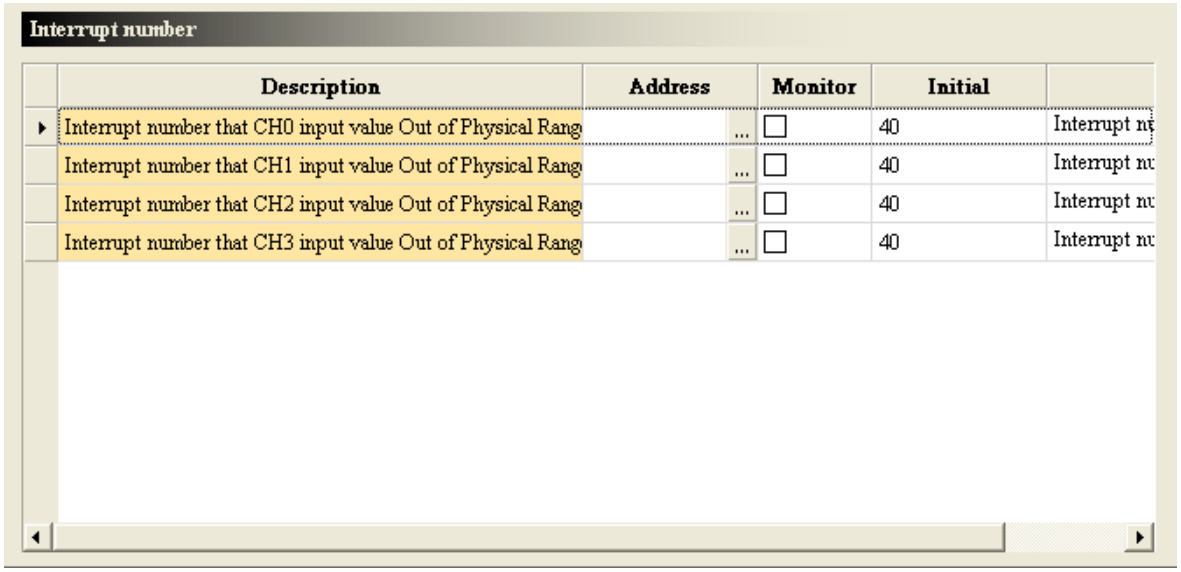
	Description	Address	Monitor	Initial	
▸	CH0 Physical Range Detect	...	☐	☑ Enable	CH0 Physi
	CH1 Physical Range Detect		☐	☑ Enable	CH0 Physic
	CH2 Physical Range Detect		☐	☑ Enable	CH0 Physic
	CH3 Physical Range Detect		☐	☑ Enable	CH0 Physic
	CH0 Detect is Alarm or warning		☐	☑ Alarm	CH0 Physic
	CH1 Detect is Alarm or warning		☐	☑ Alarm	CH0 Physic
	CH2 Detect is Alarm or warning		☐	☑ Alarm	CH0 Physic
	CH3 Detect is Alarm or warning		☐	☑ Alarm	CH0 Physic

(6) Enabling the interrupts

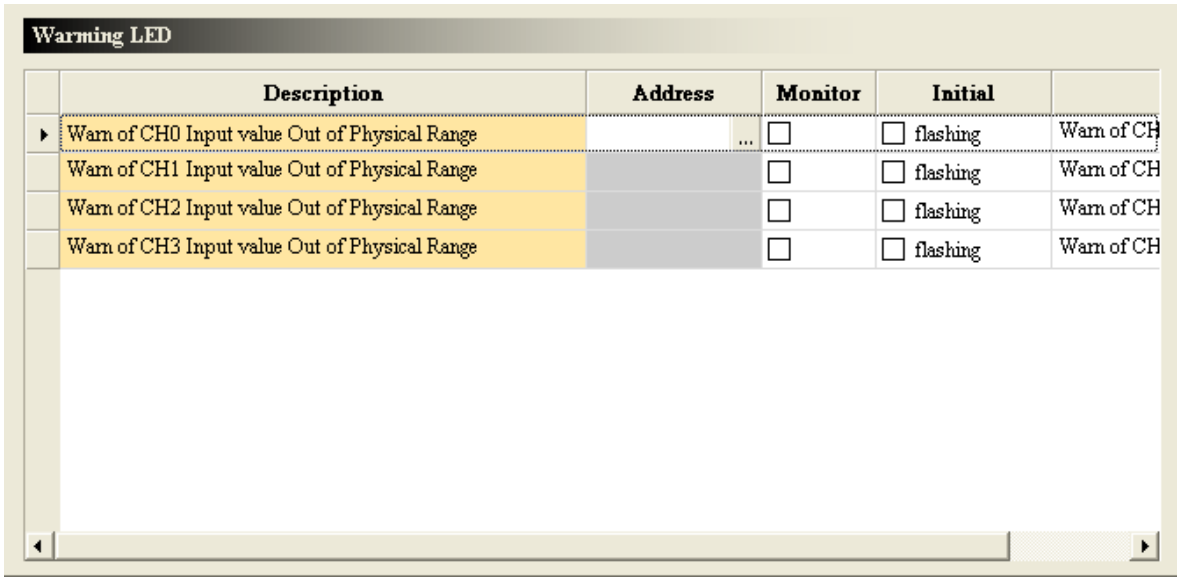
Interrupt Enable

	Description	Address	Monitor	Initial	
▸	CH0 Interrupt of Over Physical Range	...	☐	☐ Enable	CH0 Interr
	CH1 Interrupt of Over Physical Range		☐	☐ Enable	CH0 Interr
	CH2 Interrupt of Over Physical Range		☐	☐ Enable	CH0 Interr
	CH3 Interrupt of Over Physical Range		☐	☐ Enable	CH0 Interr

(7) The interrupt numbers

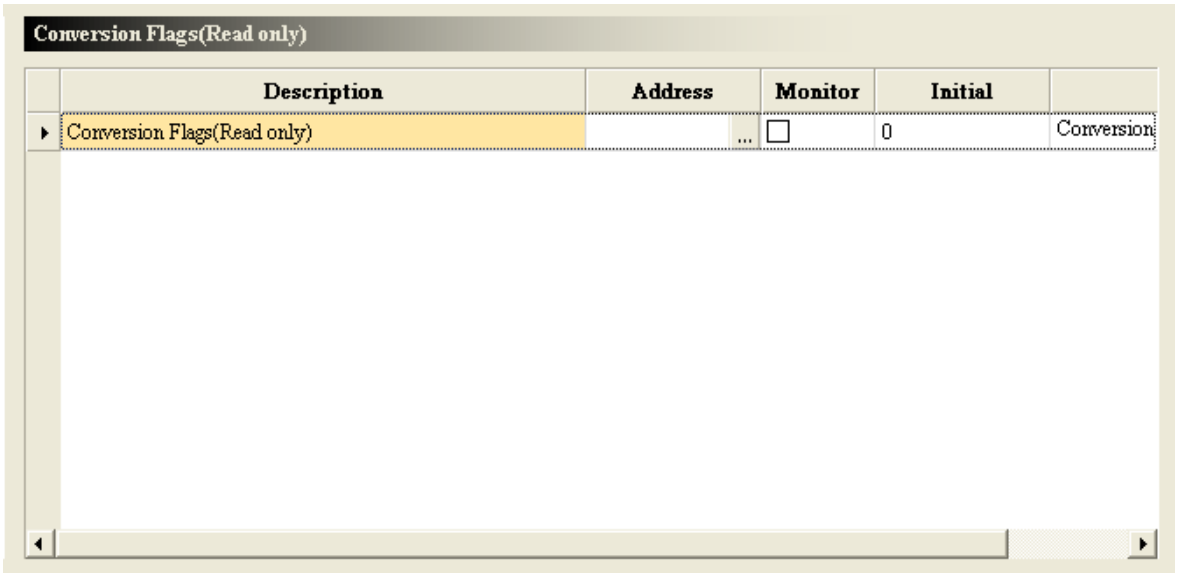


(8) Setting the warning LED indicator



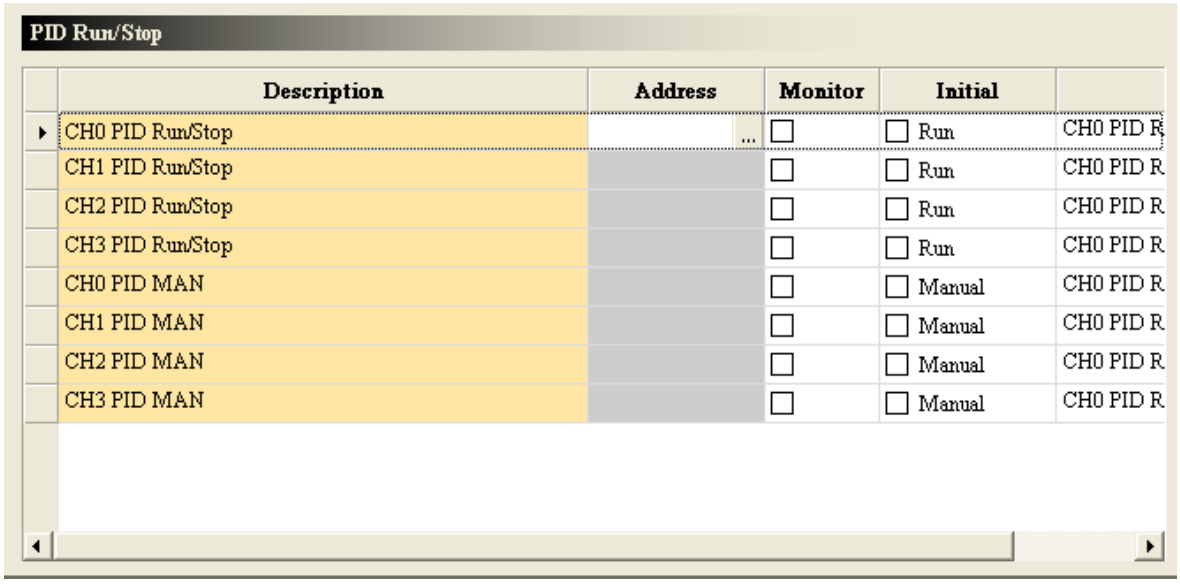
Description	bit0~bit3: CH0~CH3 (Warning LED indicator) (ON: Flash; OFF: Not flash)

(9) The error codes

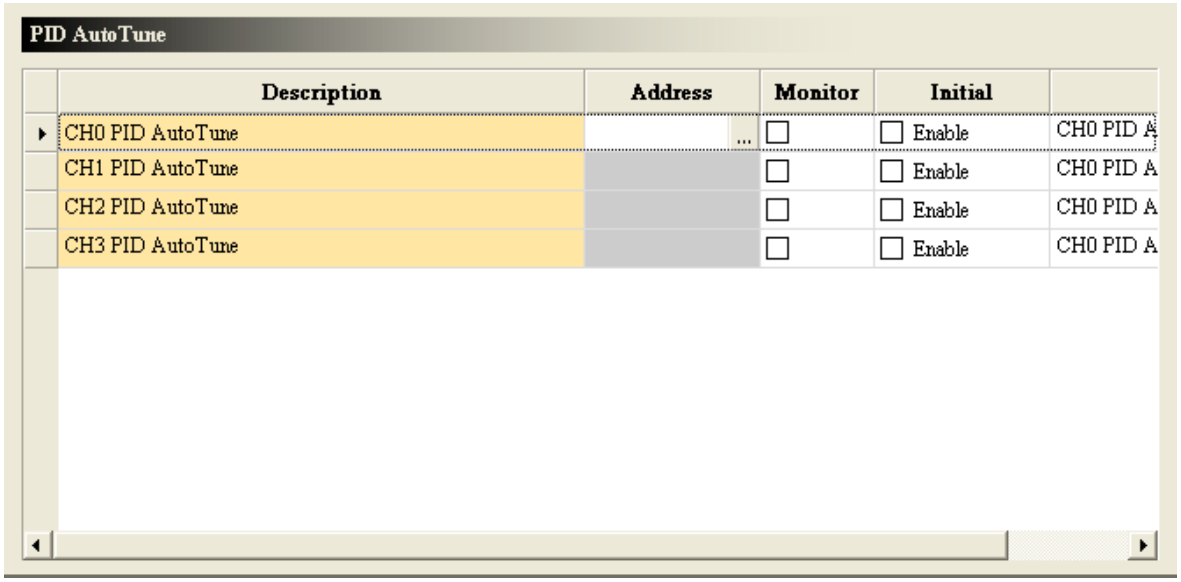


Description	bit0~bit3: The signals received by the CH0~CH3 exceed the range of inputs which can be received by the hardware. bit15: The external voltage is abnormal.

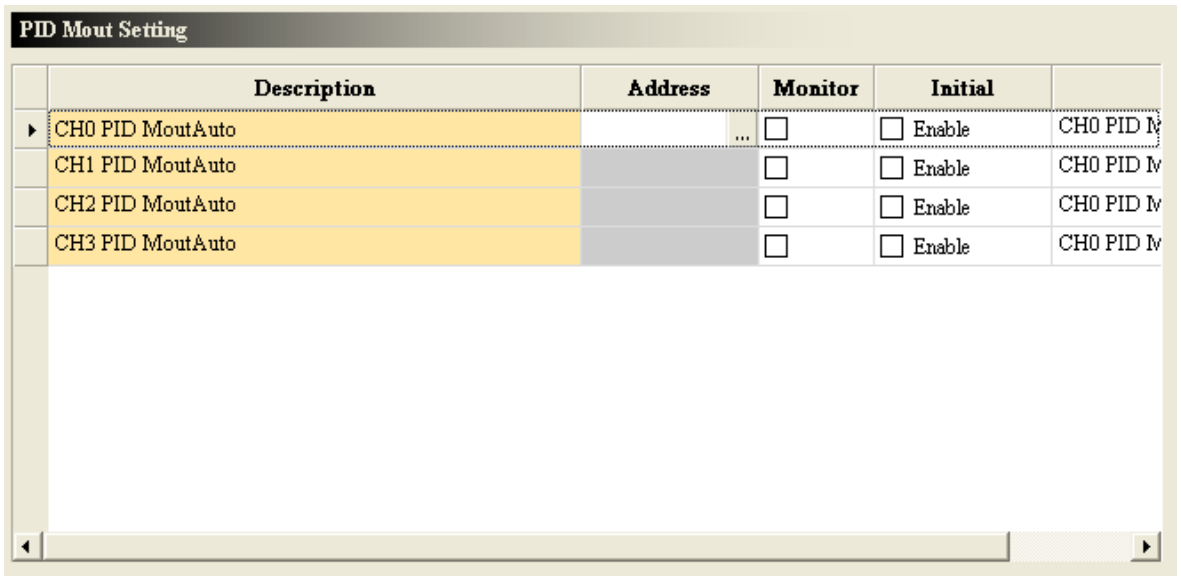
(10) Performing/Not performing the PID algorithm



(11) The automatic tuning



(12) Refreshing the manual output values automatically



5

(13) The heating/cooling mode

PID heater/cooler

	Description	Address	Monitor	Initial	
▸	CH0 PID Heater/Cooler	...	☐	☐ Cooler	CH0 PID H
	CH1 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH2 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH3 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H

(14) The target values

PID SV

	Description	Address	Monitor	Initial	
▸	CH0 SV	...	☐	0.000000	CH0 SV
	CH1 SV	...	☐	0.000000	CH1 SV
	CH2 SV	...	☐	0.000000	CH2 SV
	CH3 SV	...	☐	0.000000	CH3 SV

(15) The sampling time

PID Cycle

	Description	Address	Monitor	Initial	
▸	CH0 Cycle	...	☐	10	CH0 Cycle
	CH1 Cycle	...	☐	10	CH1 Cycle
	CH2 Cycle	...	☐	10	CH2 Cycle
	CH3 Cycle	...	☐	10	CH3 Cycle

(16) The proportional gains

PID Kp

	Description	Address	Monitor	Initial	
▸	CH0 Kp	...	☐	0.000000	CH0 Kp
	CH1 Kp	...	☐	0.000000	CH1 Kp
	CH2 Kp	...	☐	0.000000	CH2 Kp
	CH3 Kp	...	☐	0.000000	CH3 Kp

(17) The integral gains

PID Ki

	Description	Address	Monitor	Initial	
▸	CH0 Ki	...	☐	0.000000	CH0 Ki
	CH1 Ki	...	☐	0.000000	CH1 Ki
	CH2 Ki	...	☐	0.000000	CH2 Ki
	CH3 Ki	...	☐	0.000000	CH3 Ki

(18) The derivative gains

PID Kd

	Description	Address	Monitor	Initial	
▸	CH0 Kd	...	☐	0.000000	CH0 Kd
	CH1 Kd	...	☐	0.000000	CH1 Kd
	CH2 Kd	...	☐	0.000000	CH2 Kd
	CH3 Kd	...	☐	0.000000	CH3 Kd

(19) The range within which the error values are count as 0

PID ERR_DBW

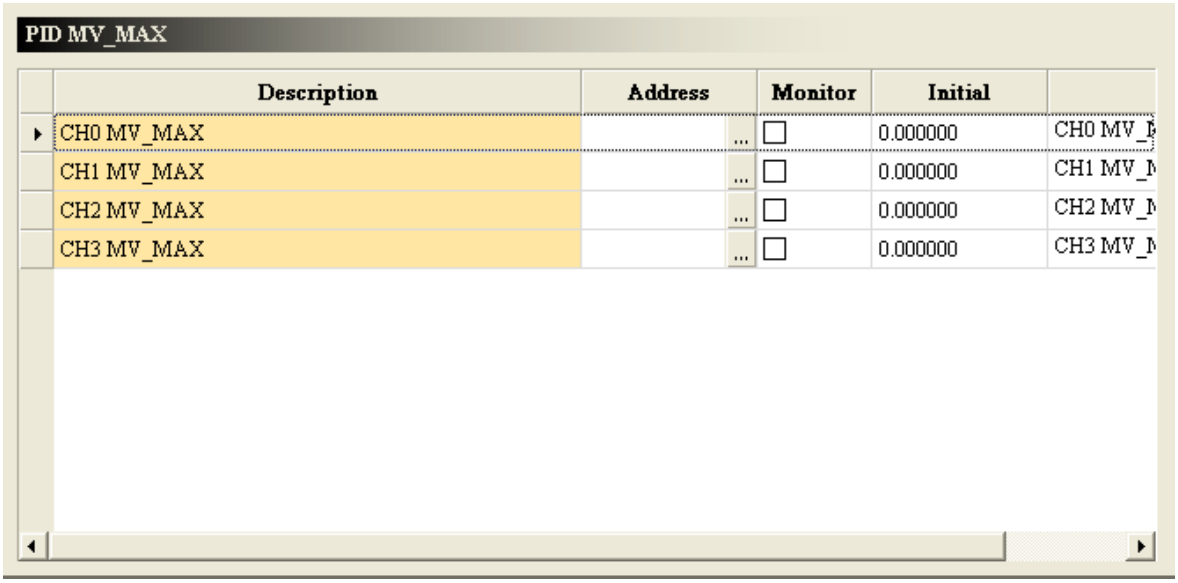
	Description	Address	Monitor	Initial	
▸	CH0 ERR_DBW	...	☐	0.000000	CH0 ERR_I
	CH1 ERR_DBW	...	☐	0.000000	CH1 ERR_I
	CH2 ERR_DBW	...	☐	0.000000	CH2 ERR_I
	CH3 ERR_DBW	...	☐	0.000000	CH3 ERR_I

(20) The manual output values

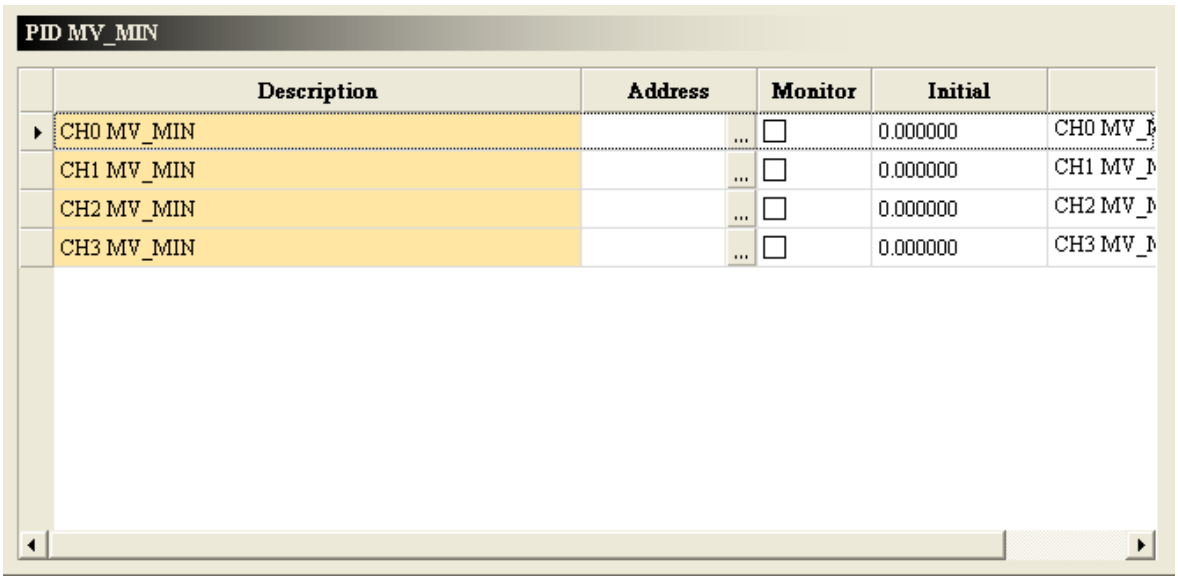
PID MOUT

	Description	Address	Monitor	Initial	
▸	CH0 MOUT	...	☐	0.000000	CH0 MOU
	CH1 MOUT	...	☐	0.000000	CH1 MOU
	CH2 MOUT	...	☐	0.000000	CH2 MOU
	CH3 MOUT	...	☐	0.000000	CH3 MOU

(21) The maximum output values



(22) The minimum output values



(23) Reading the output values

PID MV(Read only)

	Description	Address	Monitor	Initial	
▸	CH0 MV(Read only)	...	☐	0.000000	CH0 MV(F
	CH1 MV(Read only)	...	☐	0.000000	CH1 MV(R
	CH2 MV(Read only)	...	☐	0.000000	CH2 MV(R
	CH3 MV(Read only)	...	☐	0.000000	CH3 MV(R

(24) The accumulated integral values

PID I_MV(Read only)

	Description	Address	Monitor	Initial	
▸	CH0 I_MV(Read only)	...	☐	0.000000	CH0 I_MV
	CH1 I_MV(Read only)	...	☐	0.000000	CH1 I_MV
	CH2 I_MV(Read only)	...	☐	0.000000	CH2 I_MV
	CH3 I_MV(Read only)	...	☐	0.000000	CH3 I_MV

5.5 Troubleshooting

5.5.1 Error Codes

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A600	Alarm	Hardware failure	OFF	ON
16#A601	Alarm	The external voltage is abnormal.	OFF	ON
16#A603	Alarm	Internal error The factory correction is abnormal.	OFF	ON
16#A400	Alarm	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A401	Alarm	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A402	Alarm	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A403	Alarm	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A000	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A001	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A002	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A003	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A800	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A801	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A802	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A803	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	OFF

5.5.2 Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.
The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.

Description	Procedure
Internal error The factory correction is abnormal.	Please contact the factory.
The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 0.
The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 2.
The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 3.

Chapter 6 Temperature Measurement Module AH04TC-5A / AH08TC-5A

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6.1 Overview

The specifications for AH04TC-5A and AH08TC-5A, the operation, and the programming are described in this chapter. AH04TC-5A and AH08TC-5A are temperature measurement modules. They convert temperatures received from thermocouples into digital signals. Users can select the degree Celsius or the degree Fahrenheit as a unit of measurement for temperature.

An introduction of thermocouples

The Seebeck effect is used in a thermocouple to measure a temperature difference. Generally speaking, a thermocouple consists of two conductors of different materials that produce a voltage in the vicinity of the point where the two conductors are in contact. The voltage produced is dependent on the difference of temperature of the junction to other parts of those conductors, and is in the range of several ten microvolts to several thousand microvolts. Therefore, the voltage produced needs to be amplified.

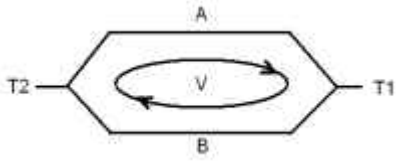
A thermocouple creates a voltage when there is a temperature difference. When a differential operation is performed on two pieces of data, external noise is eliminated. The stability of thermocouples is better than thermistors, resistance thermometers, and thermal resistors. Therefore, thermocouples are widely used in industry.

A thermocouple consists of a circuit having two wires of different metals or metal alloys welded together or joined at both ends. One of the junctions—normally the cold junction—is maintained at a known reference temperature, and the other junction is at the temperature to be sensed. A temperature gradient across the junction of the wires gives rise to an electric potential by the Seebeck effect. The voltage produced is proportional to the difference of temperature of the junction to other parts of those conductors.

The voltage can be derived from:

$$V = \int_{T_1}^{T_2} (Q_A - Q_B) dT \qquad \text{(A)}$$

where Q_A and Q_B are the thermopowers (Seebeck coefficient) of the metals A and B, and T_1 and T_2 are the temperatures of the two junctions.



Principle of operation

In fact, Q_A and Q_B are almost unrelated to temperature. Therefore, formula (A) above can be approximated as (B) below.

$V=\alpha(T_2- T_1)$ (B)

There are two types of thermocouple thermometers. They are wrapped thermocouples and bare thermocouples. A wrapped thermocouple is wrapped in protective metal, and is similar to an electric spoon in appearance. Wrapped thermocouples are used to measure temperature of liquid, and bare thermocouples are used to measure temperature of gas.

6.1.1 Characteristics

(1) **A sensor is selected according to practical application.**
Type J thermocouples, type K thermocouples, type R thermocouples, type S thermocouples, type T thermocouples, type E thermocouples, type N thermocouples, and ±150 mV voltage inputs

(2) **A module is selected according to practical application.**
AH-04TC-5A: There are four channels. Inputs received by a channel are temperatures.

AH-08TC-5A: There are eight channels. Inputs received by a channel are temperatures.

(3) **High-speed conversion**
A temperature is converted into a digital signal at a speed of 200 μs a channel.

(4) **High accuracy**
Conversion accuracy: The error is ±0.5% of an input. (The ambient temperature is 25±5°C.)

(5) **Disconnection detection**
When a sensor is disconnected, the module gives an alarm or a warning.

(6) **PID control**
An object can be maintained at a desired temperature through a PID control action.

(7) **A module can be set by means of utility software.**
HWCONFIG is built-in utility software in ISPSoft. Users can set modes and parameters in HWCONFIG to complete hardware configuration without spending time writing a program to set registers corresponding to functions.

6.2 Specifications and Functions

6.2.1 Specifications

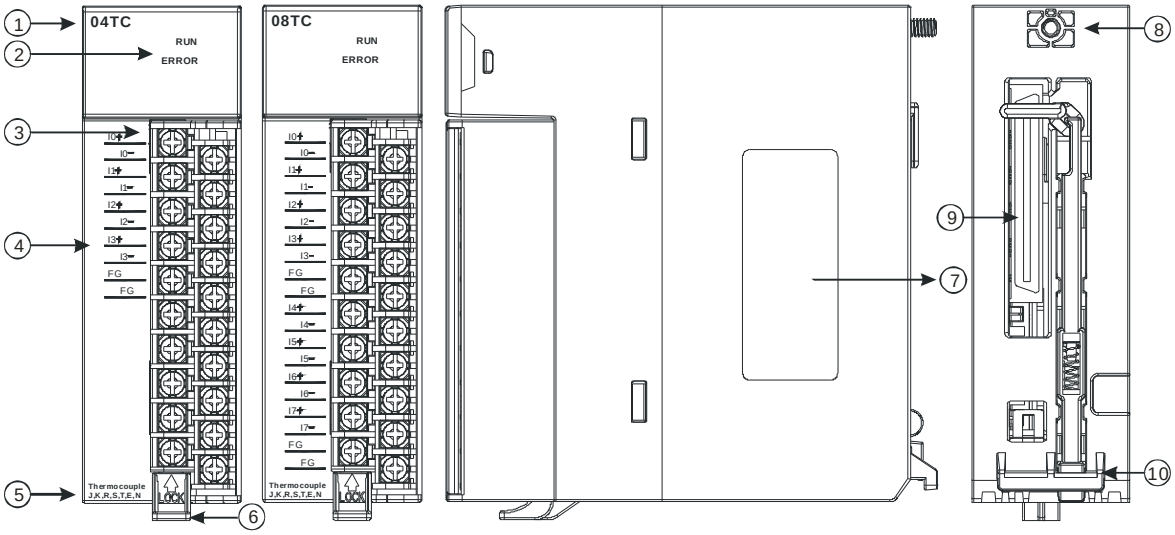
Electrical specifications

Module name	AH04TC-5A	AH08TC-5A
Number of analog inputs	4	8
Applicable sensor	Type J, type K, type R, type S, type T, type E, and type N thermocouples ±150 mV voltage inputs	
Supply voltage	24 V DC (20.4 V DC~28.8 V DC) (-15%~+20%)	
Connector type	Removable terminal block	
Overall accuracy	25°C/77°F: The error is ±0.5% of the input within the range -20~60°C/-4~140°F: The error is ±1% of the input within the range	
Conversion time	200 ms/channel	
Isolation	There is isolation between a digital circuit and an analog circuit, and there is isolation between analog channels. Isolation between a digital circuit and a ground: 500 V DC Isolation between an analog circuit and a ground: 500 V DC Isolation between an analog circuit and a digital circuit: 500 V DC Isolation between the 24 V DC and a ground: 500 V DC Isolation between analog channels: 120 V AC	

Functional specifications

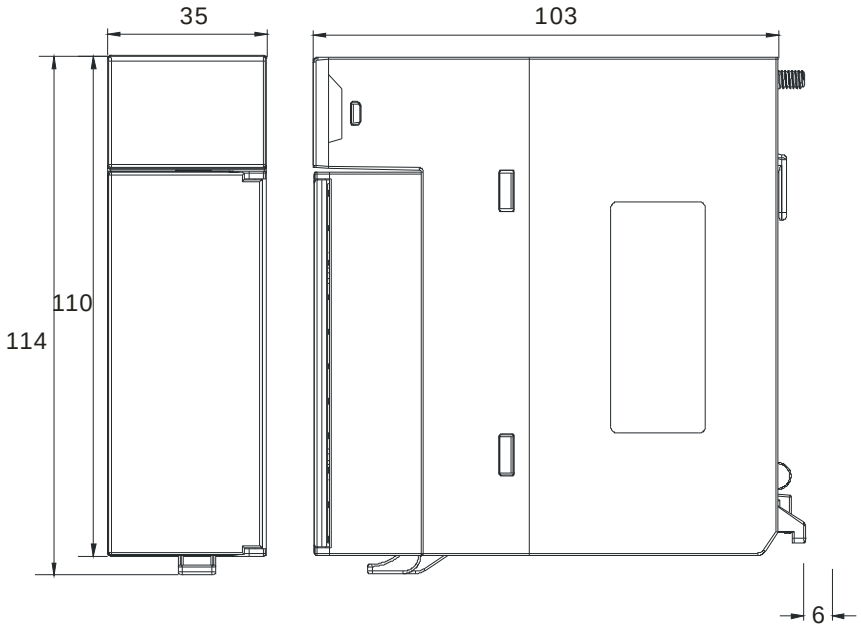
Analog-to-digital conversion	Centigrade (°C)	Fahrenheit (°F)	Voltage input
Rated input range	Type J: -100°C~1,150°C Type K: -100°C~1,350°C Type R: 0°C~1,750°C Type S: 0°C~1,750°C Type T: -150°C~390°C Type E: -150°C~980°C Type N: -150°C~1,280°C	Type J: -148°F~2,102°F Type K: -148°F~2,462°F Type R: 32°F~3,182°F Type S: 32°F~3,182°F Type T: -238°F~734°F Type E: -238°F~1,796°F Type N: -238°F~2,336°F	±150 mV
Average function	Range: 1~100		
Self-diagnosis	Disconnection detection		

6.2.2 Profile



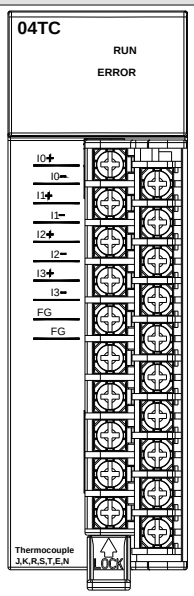
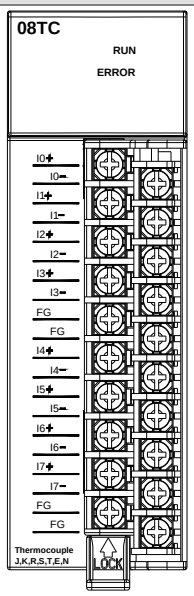
Number	Name	Description
1	Model name	Model name of the module
2	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.
3	Removable terminal block	The inputs are connected to sensors.
4	Arrangement of the input terminals	Arrangement of the terminals
5	Description of the inputs	Simple specifications for the module
6	Clip	Removing the terminal block
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

6.2.3 Dimensions



Unit: mm

6.2.4 Arrangement of Terminals

AH04TC-5A	AH08TC-5A
	

6.2.5 Functions

Item	Function	Description
1	Enabling/Disabling a channel	1. Users can enable or disable a channel. 2. If a channel is disabled, the total conversion time is decreased.
2	Temperature unit	Users can select the degree Celsius (°C) or the degree Fahrenheit (°F) as a unit of measurement for temperature.
3	Calibration	Users can calibrate a linear curve.
4	Average	Conversion values are averaged and filtered.
5	Disconnection detection	When a sensor is disconnected, the module gives an alarm or a warning.
6	Channel detection	If an input signal exceeds a range of inputs which can be received by hardware, the module will give an alarm or a warning. a. Warning LED indicator: When a warning occurs, the error LED indicator blinks or does not blink. b. Interrupt: An interrupt service routine is enabled.
7	PID control	An object can be maintained at a desired temperature through a PID control action.

1. Enabling/Disabling a channel

A temperature received from a thermocouple sensor is converted into a digital value at a speed of 200 ms a channel. If a channel is not used, users can disable it to decrease the total conversion time.

2. Temperature unit

Users can select the degree Celsius (°C) or the degree Fahrenheit (°F) as a unit of measurement for temperature.

3. Calibration

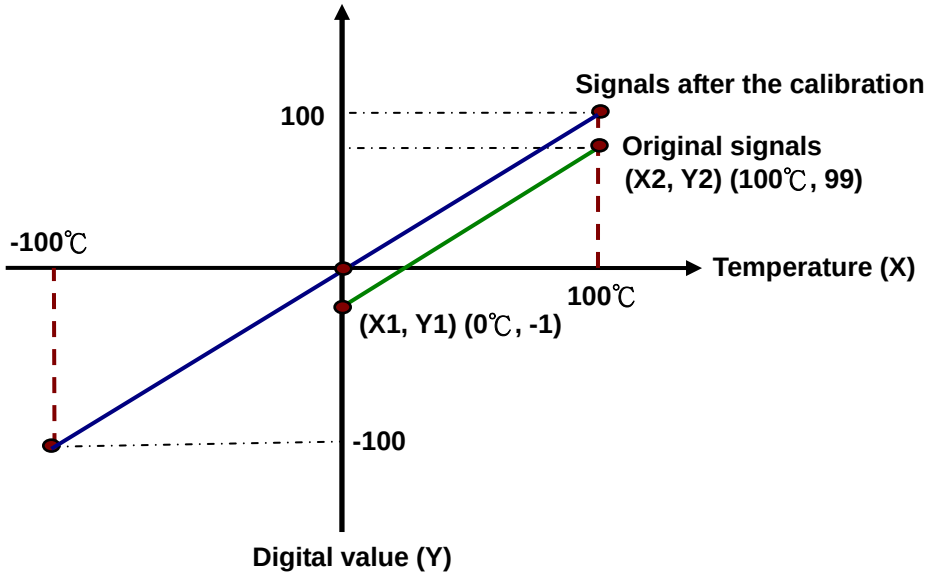
- To make a curve meet actual needs, users can calibrate the curve by changing an offset and a gain. A calibration range depends on a range of inputs which can be received by hardware.
- The range of offsets used for calibration is -1.0~1.0, and the range of gains used for calibration is 0.9~1.1.

Example 1:

The temperatures -100℃~100℃ correspond to the digital values -100~100. The original signals are used. The gain is 1, and the offset is 0. The temperature received by the channel is 0℃, and the digital value is -1. The temperature received by the channel is 100℃, and the digital value is 99. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[99-(-1)]/(100-0)=1
Gain used for calibration=1/Gain=1/1=1

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=-1
Offset used for calibration=1-Y1=1



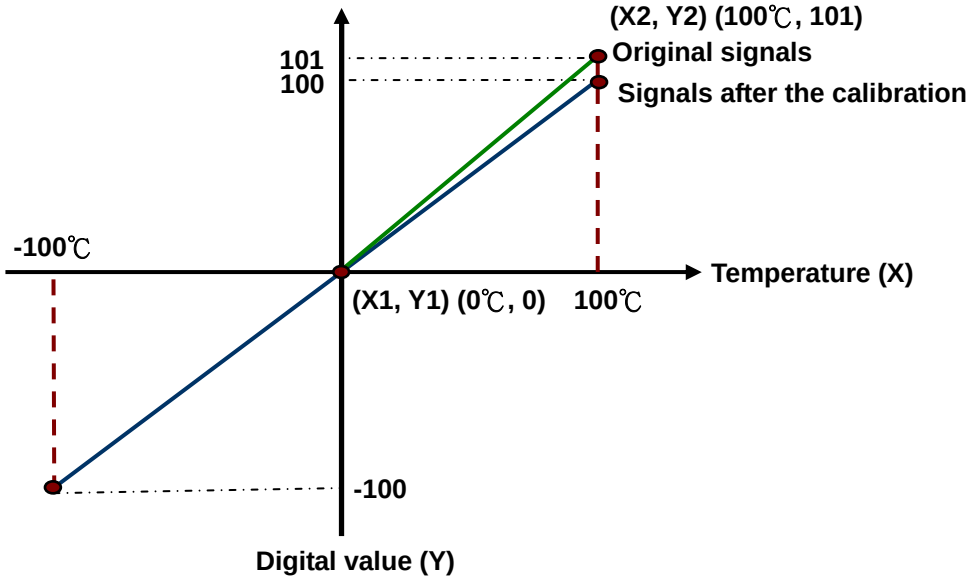
(X: Temperature; Y: Digital value)

Example 2:

The temperatures -100℃~100℃ correspond to the digital values -100~100. The original signals are used. The gain is 1, and the offset is 0. The temperature received by the channel is 0℃, and the digital value is 0. The temperature received by the channel is 100℃, and the digital value is 101. Users can calibrate the channel by calibrating the gain and the offset.

The users can get the gain for the calibration by means of the equations below.
Gain=(Y2-Y1)/(X2-X1)=[101-0]/(100-0)=1.01
Gain used for calibration=1/Gain=1/1.01=0.99

The users can get the offset for the calibration by means of the equations below.
Offset=Y1=0
Offset used for calibration=0-Y1=0



(X: Temperature; Y: Digital value)

4. Average

Digital values are averaged. The number by which the sum of several digital values is divided is between 1 and 100. The sampled values are taken as a queue, and the length of the queue is N. Each time a new sampled value is put at the end of the queue, an original value at the start of the queue is removed. The N values are averaged so that the periodic noise is suppressed.

5. Disconnection detection

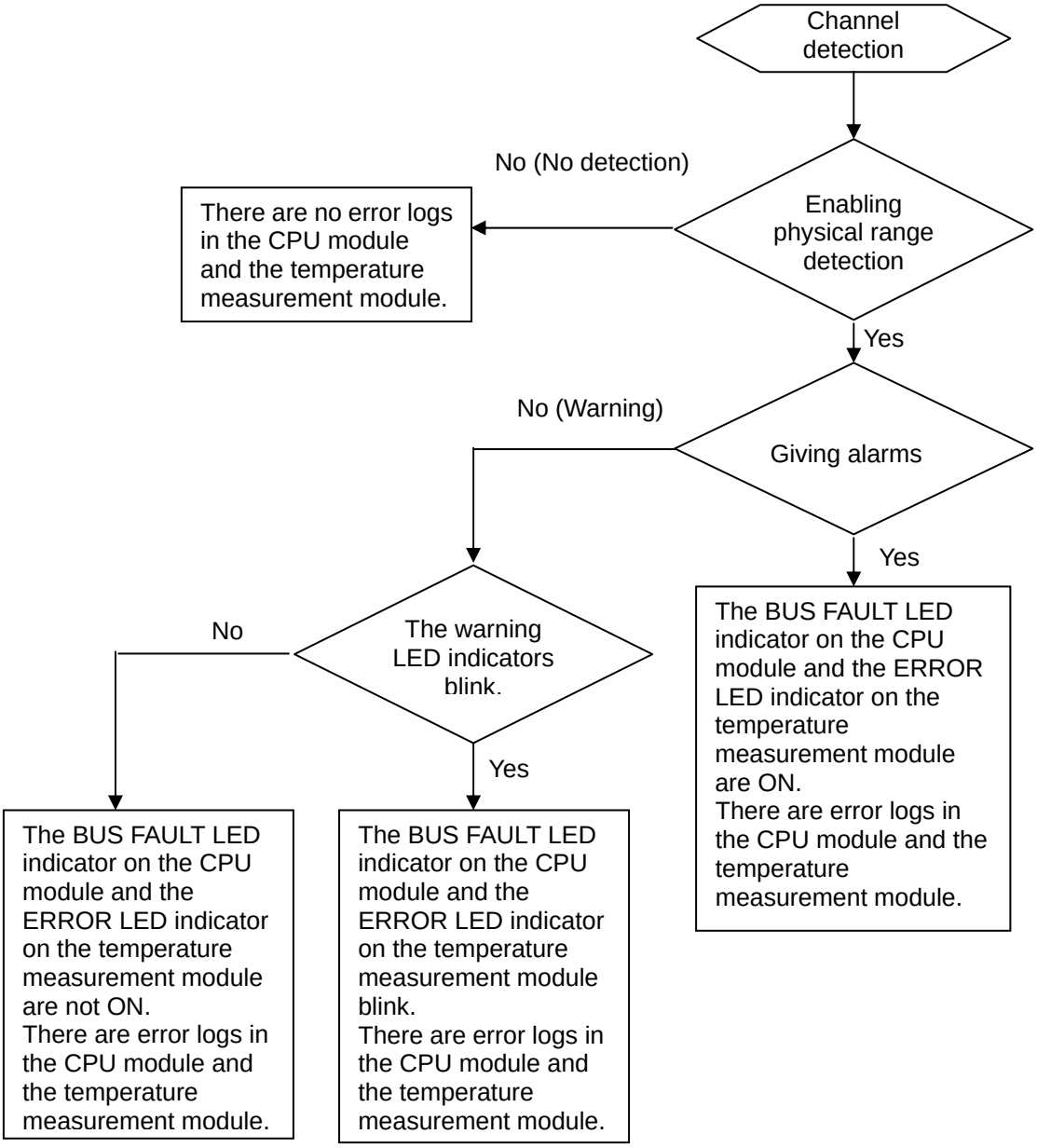
If a channel is enabled, the module will check whether a sensor is disconnected. If an input circuit is an open circuit, the module will give an alarm. Please refer to description below for more information.

6. Channel detection

If an input signal exceeds a range of inputs which can be received by hardware, an error message appears. Please refer to section 6.2.1 for more information.

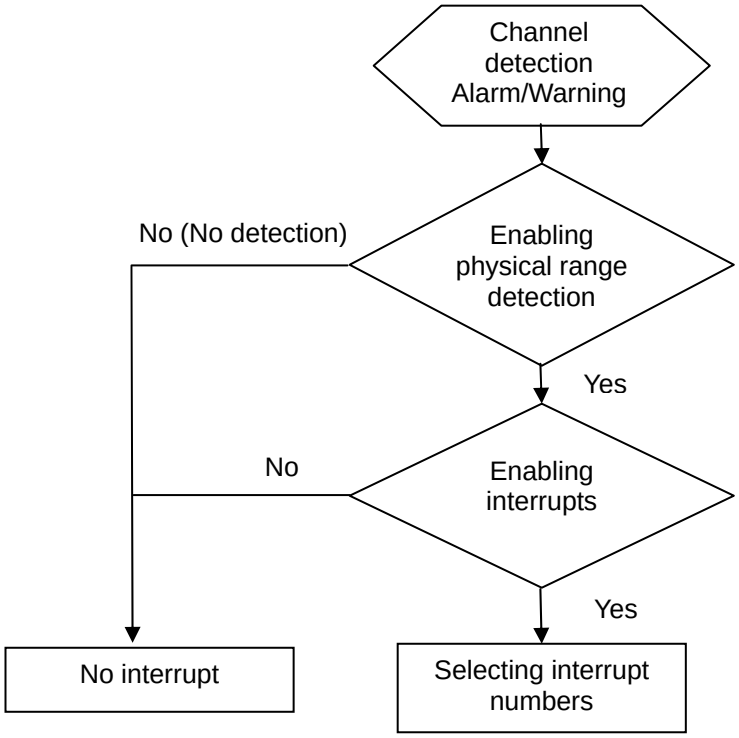
a. Giving alarms or warnings

The procedure below explains how to set a module so that it gives an alarm or a warning.


Channel detection
Enabling physical range detection
No (No detection)
There are no error logs in the CPU module and the temperature measurement module.
Yes
Giving alarms
No (Warning)
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module are ON.
There are error logs in the CPU module and the temperature measurement module.
The warning LED indicators blink.
No
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module are not ON.
There are error logs in the CPU module and the temperature measurement module.
Yes
The BUS FAULT LED indicator on the CPU module and the ERROR LED indicator on the temperature measurement module blink.
There are error logs in the CPU module and the temperature measurement module.

b. Interrupt service routine

The procedure below explains how to trigger an interrupt service routine in a CPU module.



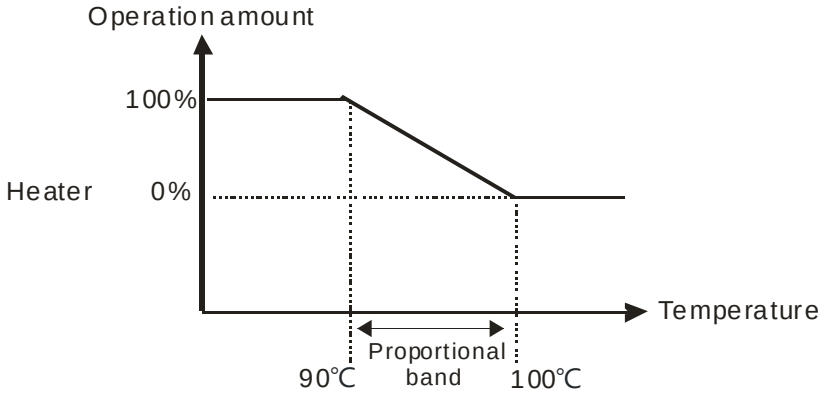
- The interrupt service routines are I40~I251.

7. PID control

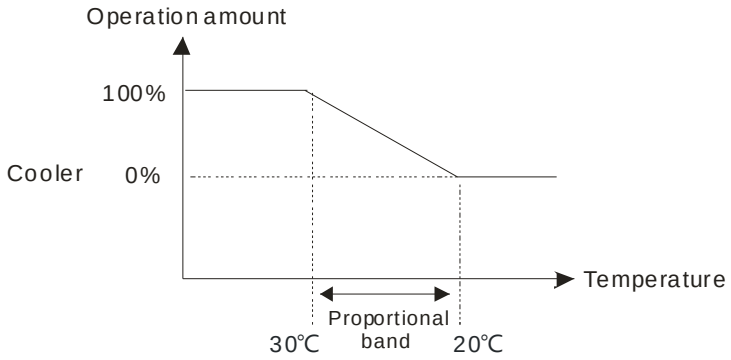
a. KP/KI/KD

Proportional action: The operation amount acts proportionally to the error. When a temperature is lower than a proportional band, the operation amount is 100%. When a temperature is within a proportional band, the operation amount decreases proportionally to the error. When the setting value is the same as the present value, the operation amount is 0%. (Error=Setting value–Present value)

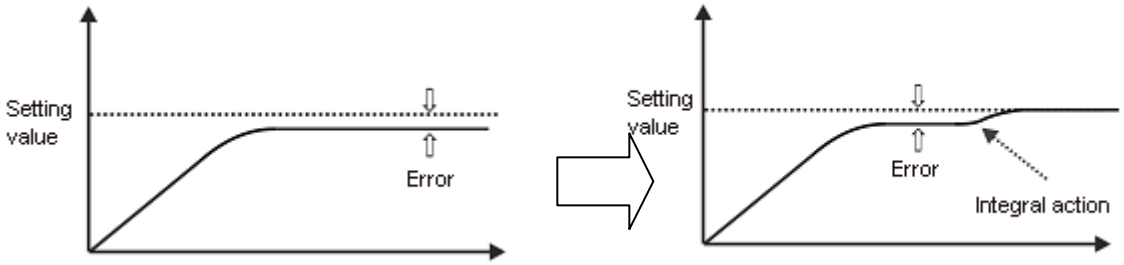
Heater: The setting value is 1000 (100°C), and K_P is 100 (10°C). The relation between the temperature and the operation amount is shown below.



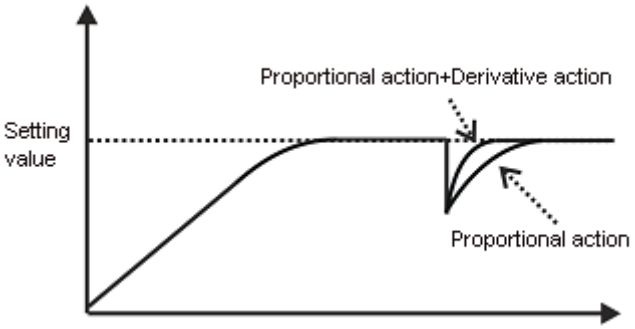
Cooler: The setting value is 200 (20°C), and KP is 100 (10°C). The relation between the temperature and the operation amount is shown below.



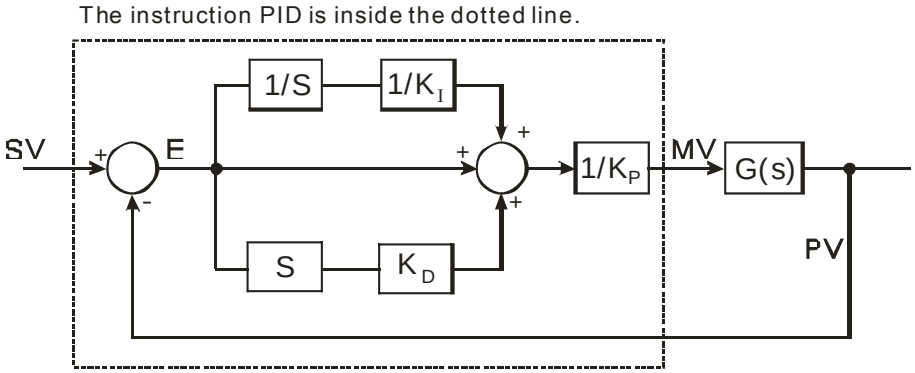
Integral action: If temperature is controlled by a pure proportional action, there is difference between the temperature controlled and a setting value. Therefore, if an integral action is used with a proportional action, difference decreases as time goes by, and the temperature controlled is the same as the setting value.



Derivative action: With regard to violent environmental change, a derivative action provides more operation amount to make temperature return to its original controlled state.



Control diagram:



The PID algorithm is as follows.

$$MV = K_P E(t) + K_I \int_0^t E(t)dt + K_D * \frac{dE(t)}{dt}$$

Forward action: $E(t) = PV(t) - SV(t)$

Reverse action: $E(t) = SV(t) - PV(t)$

b. Control mode

Cyclic control mode: Users set a cycle according to a controlled environment. (If the ambient air temperature changes slowly, the cycle can be longer.)

The width of a pulse is defined below.

- Pulse width=Output value (MV)/(Maximal output value–Minimal output value)×Cycle

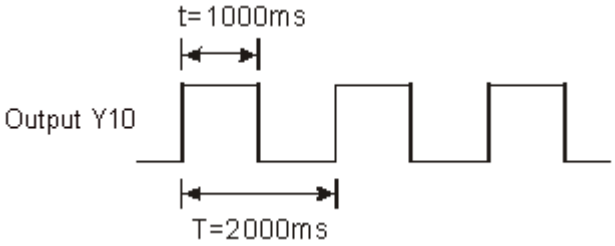
Users can set the width of a pulse and a cycle (sampling time) by means of the instruction GPWM.

Example:

The cycle is 2000 ms, the maximal output value is 100, and the minimal output value is 0. After the PID algorithm is performed, the output value gotten is 50.

- Width of a pulse=50/(100-0)×2000 ms=1000 ms

Therefore, the pulse width used in the instruction GPWM is 1000 ms, and the cycle used in the instruction GPWM is 2000 ms.



c. PID parameters

PID parameter		Description
Performing/Not performing the PID algorithm		bit0~bit3: CH0~CH3 (Performing/Not performing the PID algorithm) bit4~bit7: CH4~CH7(Performing/Not performing the PID algorithm) (AH08TC-5A) bit8~b it11: CH0~CH3 (Manual/Automatic tuning) bit12~bit15: CH4~CH7(Manual/Automatic tuning) (AH08TC-5A)
Manual/Automatic tuning		
Heating/Cooling mode		bit0~bit3: CH0~CH3 bit4~bit7 : CH4~CH7 (AH08TC-5A)
Sampling time		One-word decimal format Unit: 10 ms
Automatic mode	Automatic tuning	bit0~bit3: CH0~CH3 bit4~bit7: CH4~CH7 (AH08TC-5A)
	Refreshing the manual output values automatically	bit0~bit3: CH0~CH3 bit4~bit7: CH4~CH7 (AH08TC-5A)
	Target value	One-double word floating-point format
	Proportional gain	One-double word floating-point format
	Integral gain	One-double word floating-point format
	Derivative gain	One-double word floating-point format
	Range within which the error values are count as 0	One-double word floating-point format When the setting value is 0, the function is not enabled. For example, if the setting value is 5, and the difference between the present value and the target value is in the range of -5 to 5, the output value is 0.
	Maximum output value	One-double word floating-point format
	Minimum output value	One-double word floating-point format
	Reading the output value	One-double word floating-point format
	Accumulated integral value	One-double word floating-point format
Manual mode	Manual output value	One-double word floating-point format

d. Additional remarks on PID control

(1) If K_p, K_i, or K_d is 0, the corresponding function is disabled. For example, if users only want to use proportional control, K_i and K_d are 0.

(2) If users do not know how to adjust the parameters K_p, K_i, and K_d under a controlled environment, they can use the automatic tuning function to set the parameters, and then finely adjust the parameters to the optimum values. When the automatic tuning function is enabled, the value in a register defined by the users is 1. After the automatic tuning of the parameters is complete, the value in the register becomes 0.

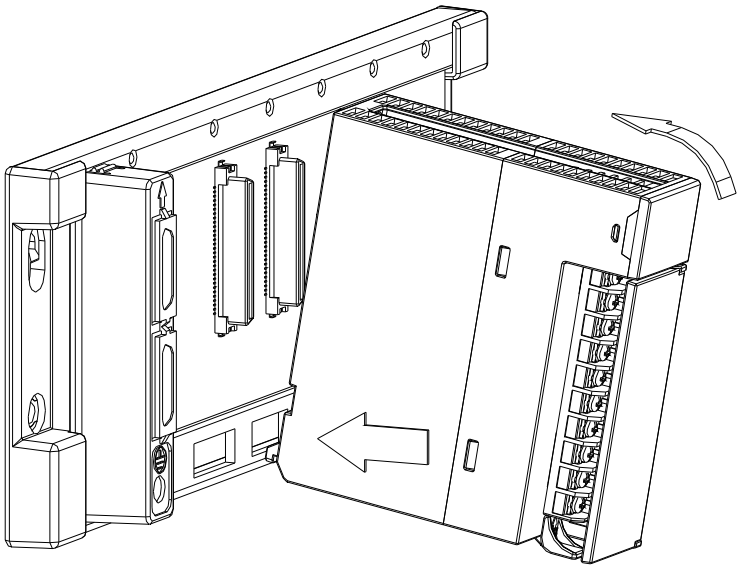
(3) If users want to set the parameters K_p, K_i, and K_d by themselves, they need to set the K_p by experience, and set the K_i, and K_d to 0. After the tuning of the K_p is complete, the users can tune the K_i, and K_d in order.

6.3 Installation

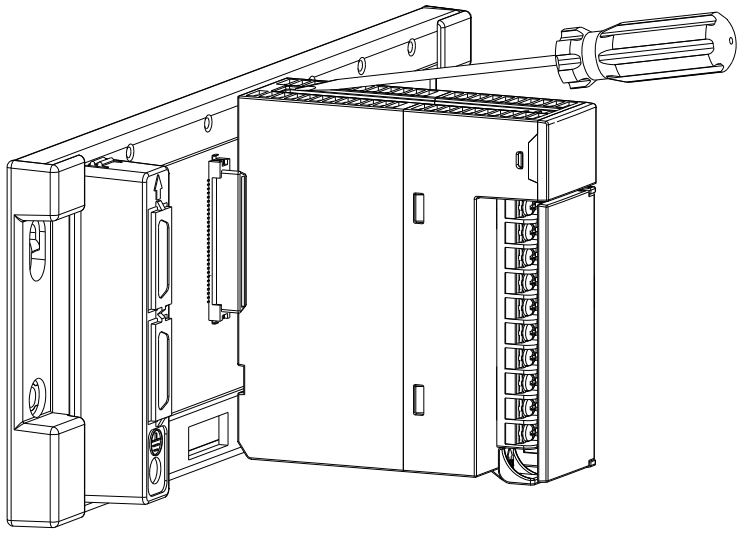
6.3.1 Installing a Module

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.



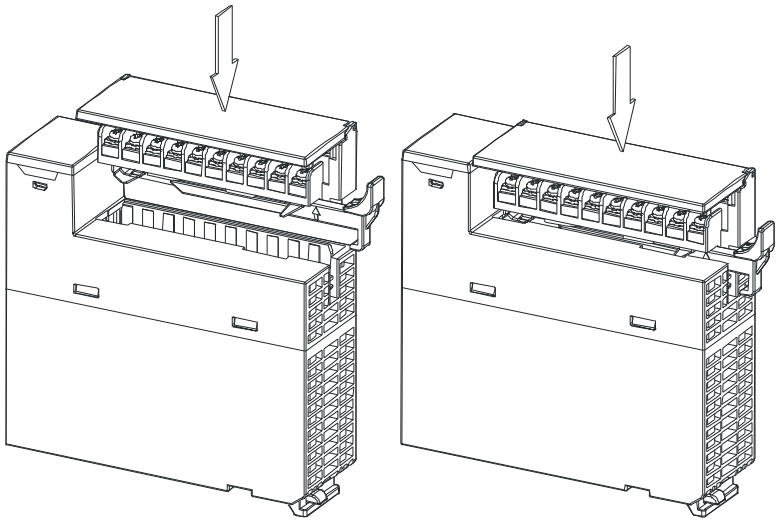
3. Tighten the screw on the module.



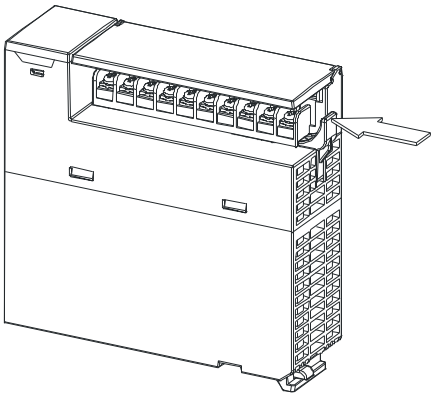
6.3.2 Installing a Removable Terminal Block

- **Installation**

1. Level a terminal block at the printed circuit board, and press it into the module.

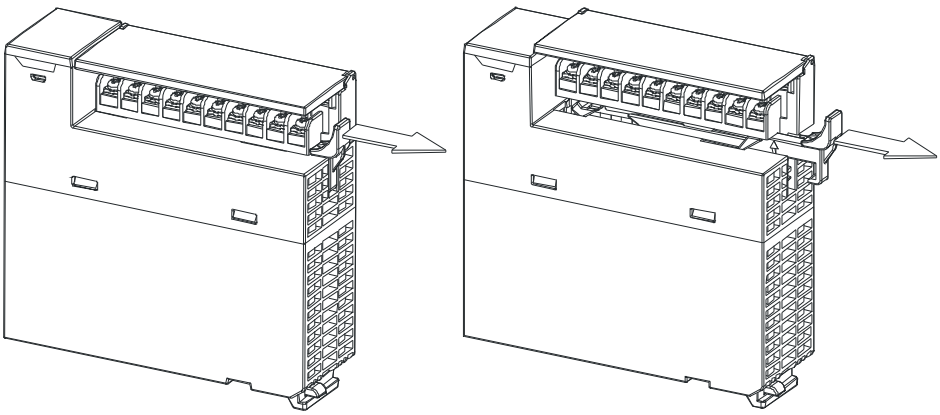


2. Press the clip in the direction indicated by the arrow.

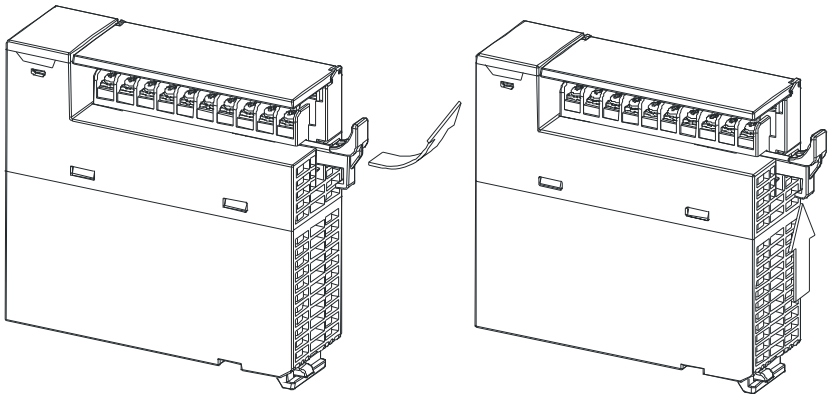


- **Removal**

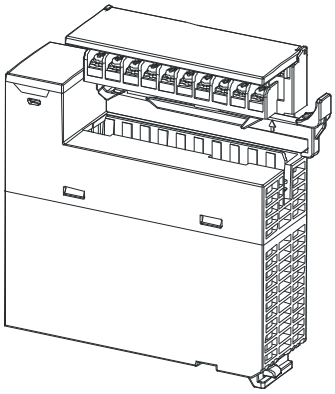
1. Pull the clip in the direction indicated by the arrow.



2. Pull up the clip.



3. The terminal block is removed.



6

6.3.3 Wiring

- **Precautions**

In order to make the functions of a temperature measurement module perfect and ensure the reliability of a system at the same time, external wiring which prevents noise is necessary. Before installing cables, users need to follow the precautions below.

(1) To prevent a surge and induction, an AC cable and input signal cables which are connected to AH04TC-5A/AH08TC-5A must be separate cables.

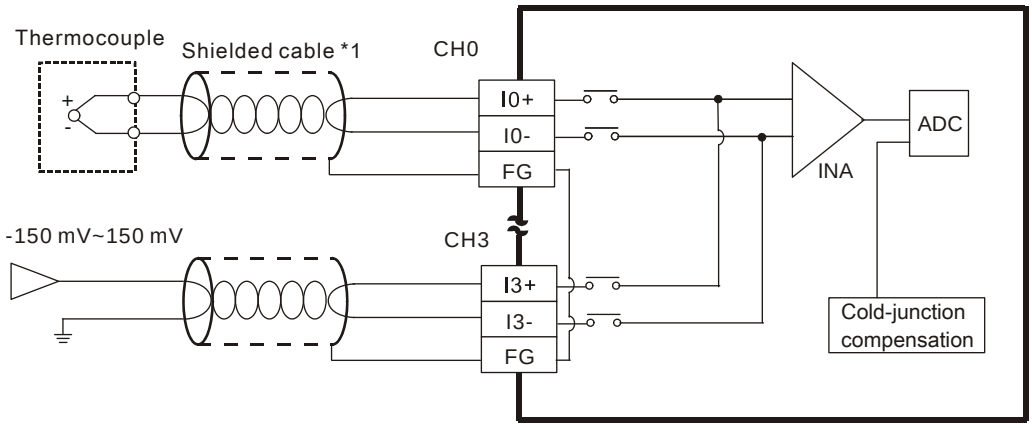
(2) A cable must not be installed near a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Besides, a cable must not be bound to a main circuit, a high-voltage cable, or a cable connected to a load which is not a PLC. Otherwise, effects that noise, induction, and a surge have will increase.

(3) Please connect a shielded cable and a hermetically sealed cable with the ground separately.

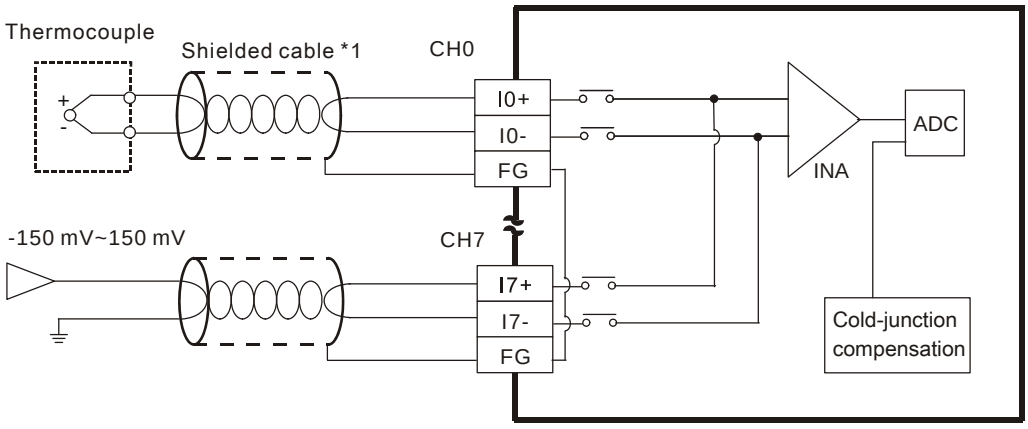
(4) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.

- **External wiring**

(1) AH04TC-5A



(2) AH08TC-5A



*1. The cables or the shielded twisted pair cables for Type J, type K, type R, type S, type T, type E, and type N thermocouples are used, and should be kept separate from other power cables and cables which generate noise.

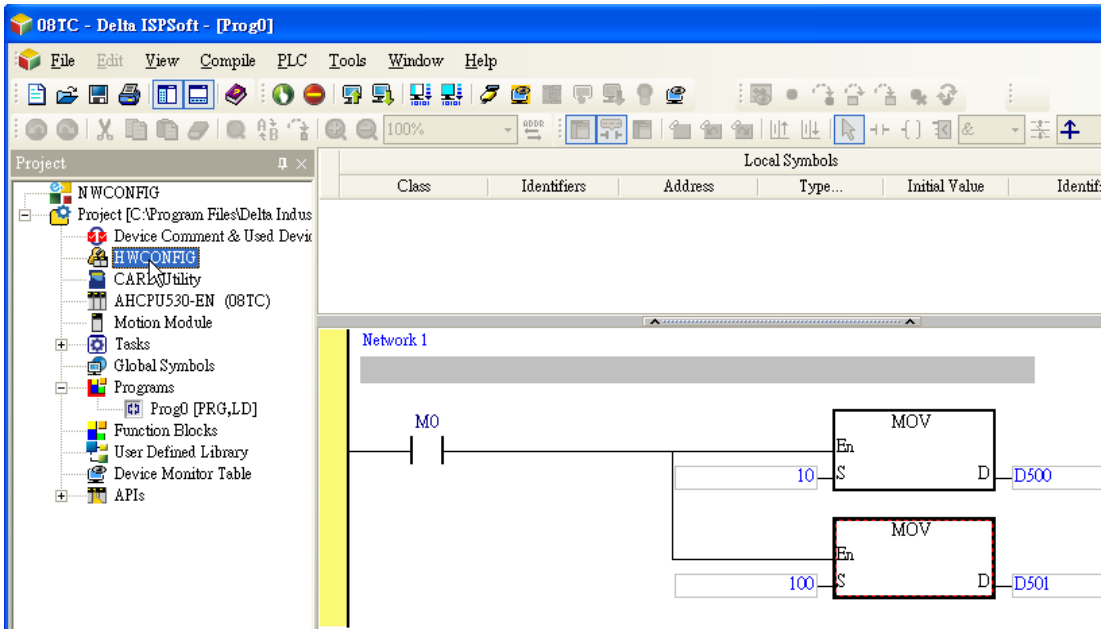
6.3.4 LED Indicators

Number	Name	Description
1	RUN LED indicator	Operating status of the module ON: The module is running. OFF: The module stops running.
2	ERROR LED indicator	Error status of the module ON: A serious error occurs in the module. OFF: The module is normal. Blink: A slight error occurs in the module.

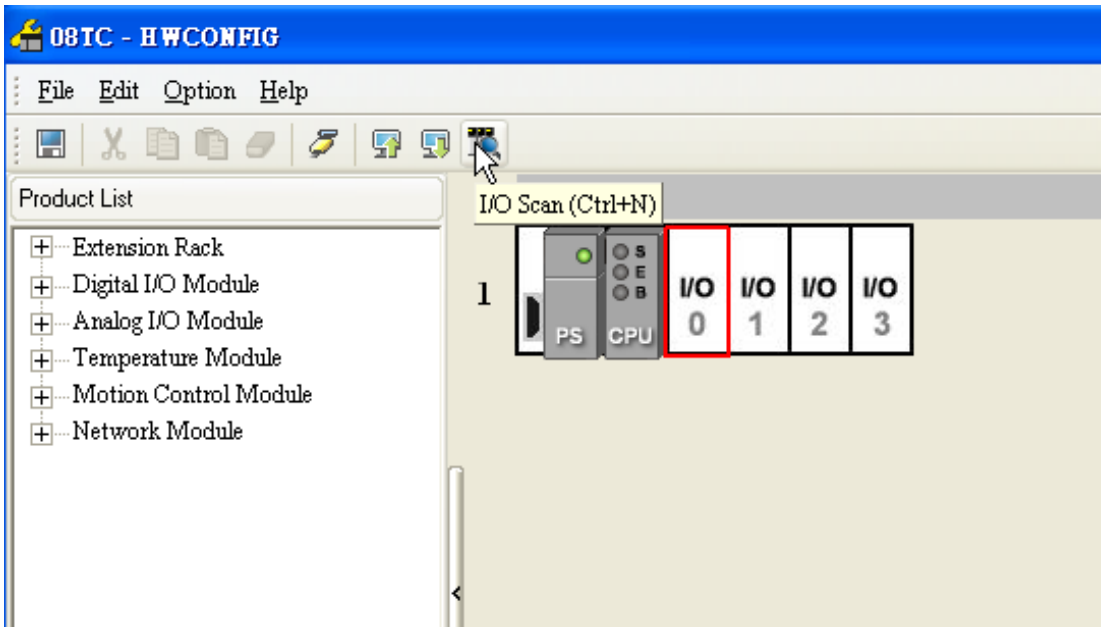
6.4 HWCONFIG in ISPSoft

6.4.1 Initial Setting

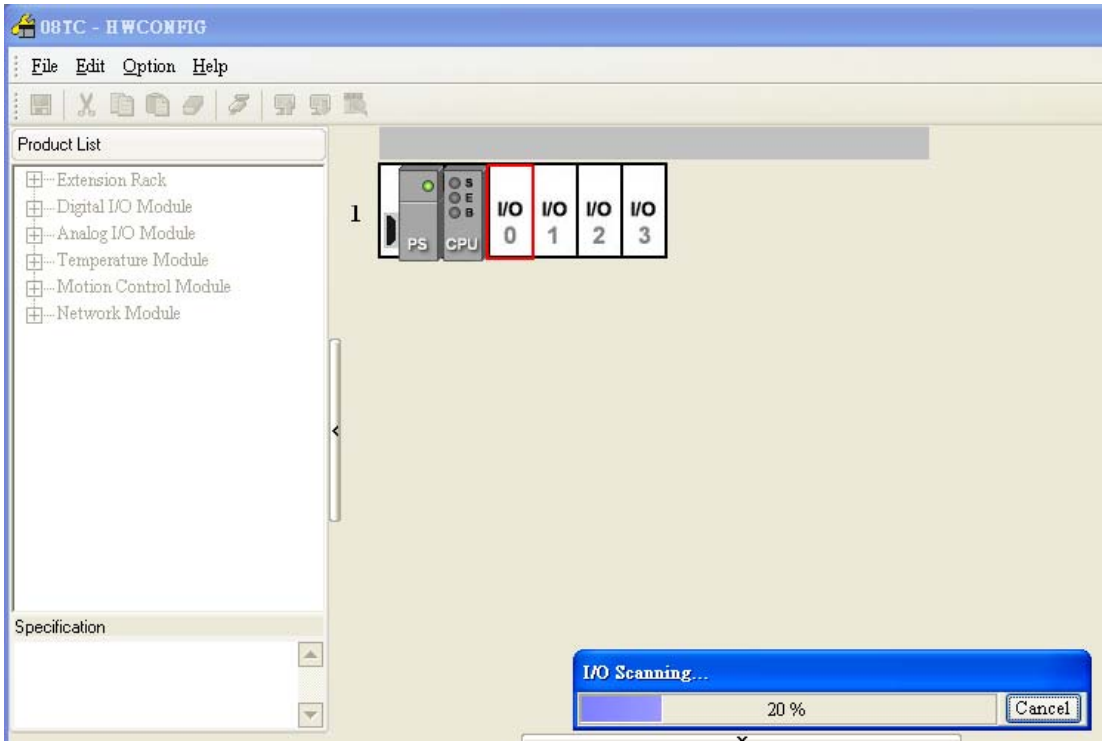
(1) Start ISPSoft, and then double-click **HWCONFIG**.



(2) Click **I/O scan** on the toolbar.



(3) ISPSoft is scanning the actual hardware configuration.



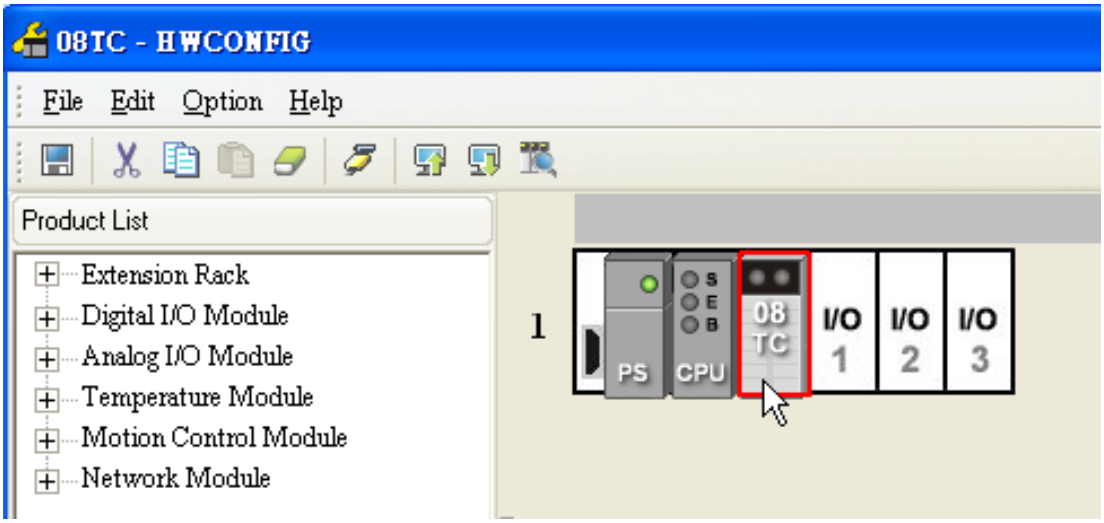
(4) After the scan of the actual hardware configuration is complete, the system automatically assigns the corresponding registers to the channels. Users can alter the input device range by themselves.

Note: Owing to the fact that values are floating-point numbers, every channel occupies two 16-bit registers.

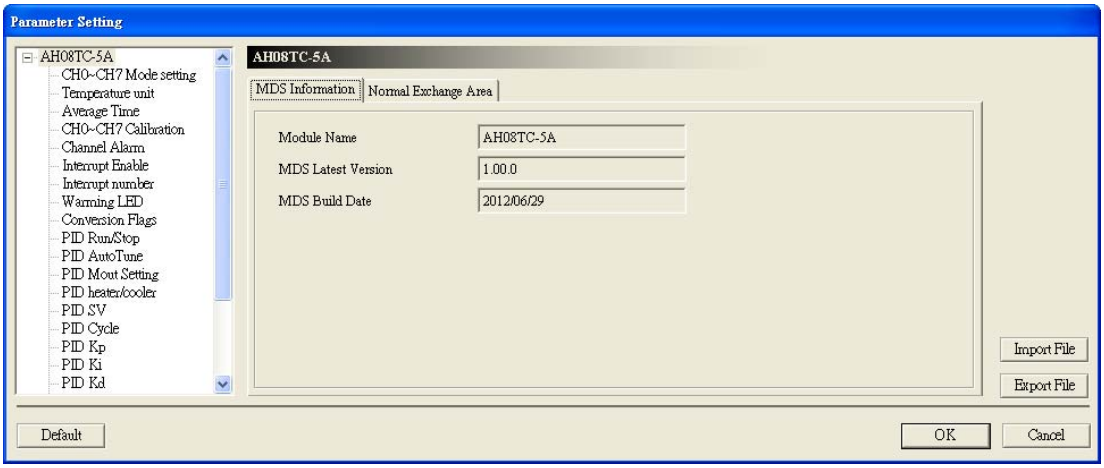
Information: Rack 1

Slot No.	Label	Firmware Versi...	Descrption	Input Device Ra...	Output Device R...
-	AHPS05-5A	-	AH Power Supply	None	None
-	AHCPU530-EI	1.00	Basic CPU module	None	None
0	AH08TC-5A	1.00	8 x 24 bit TC input	D0 ~ D15	

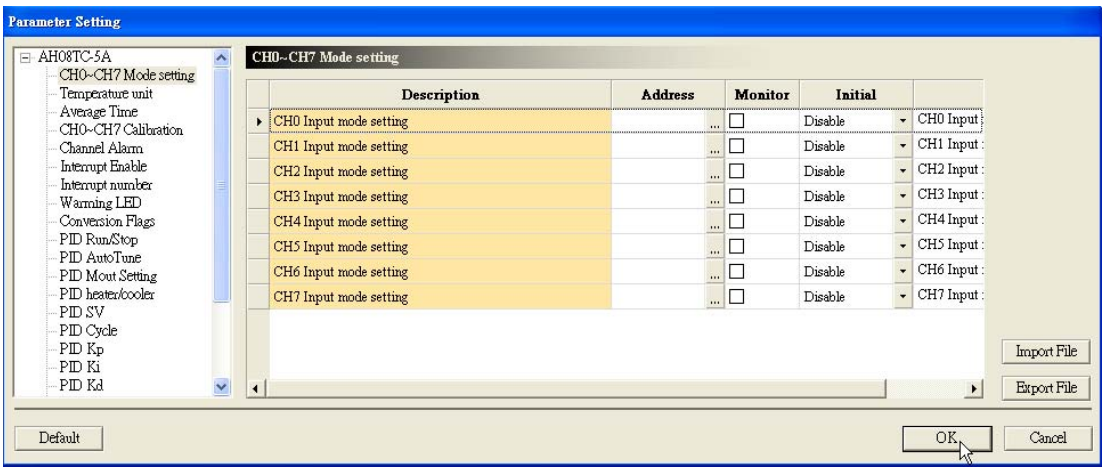
(5) Double-click the module.



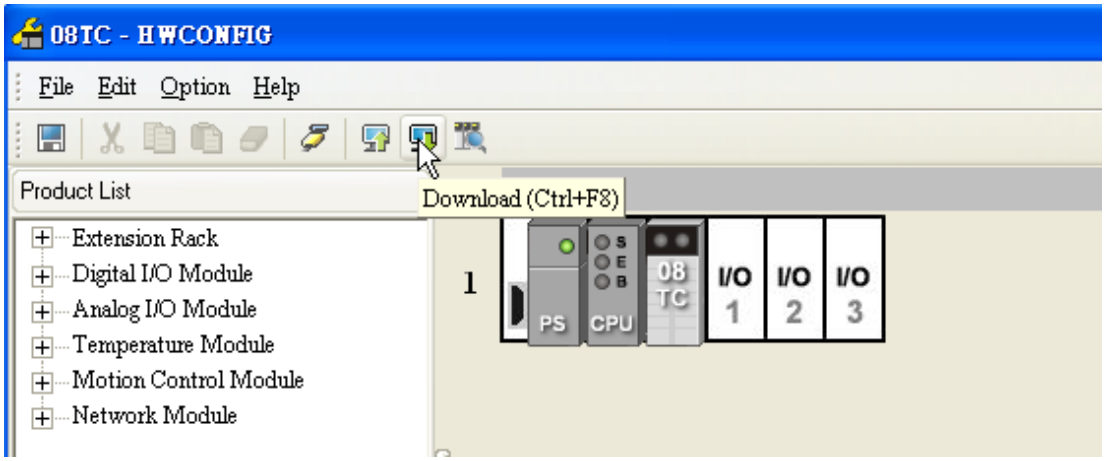
(6) Open the **Parameter Setting** window.



(7) Set the parameters, and then click **OK**.

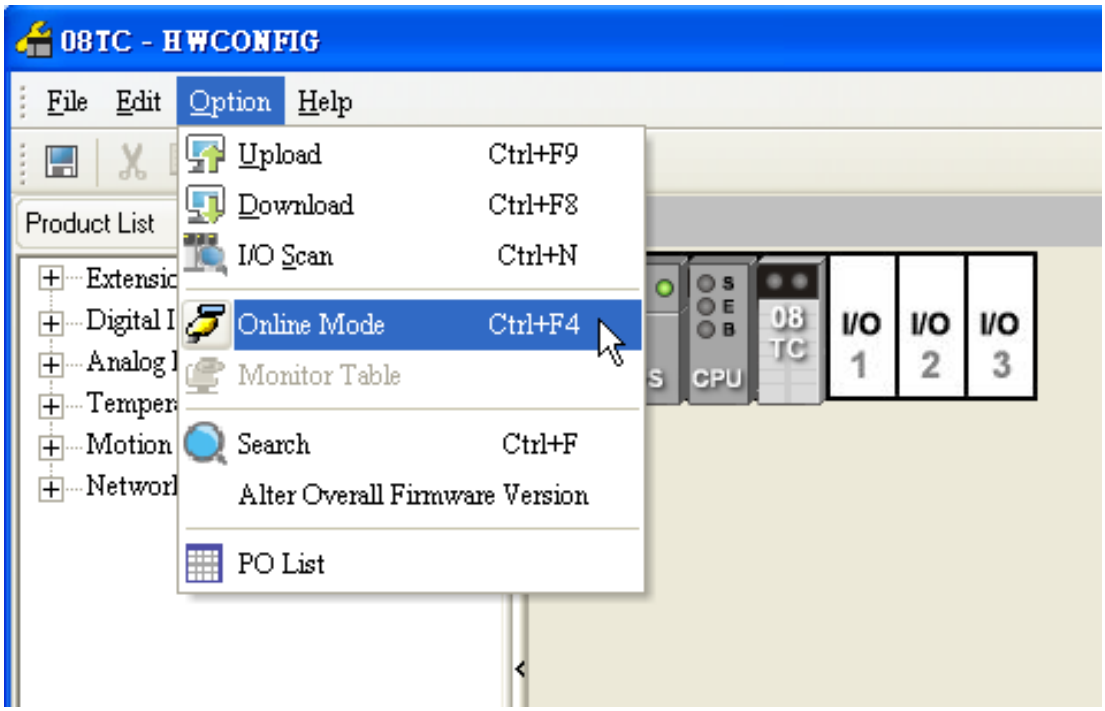


(8) Click **Download** on the toolbar to download the parameters. (The parameters can not be downloaded when the CPU module runs.)

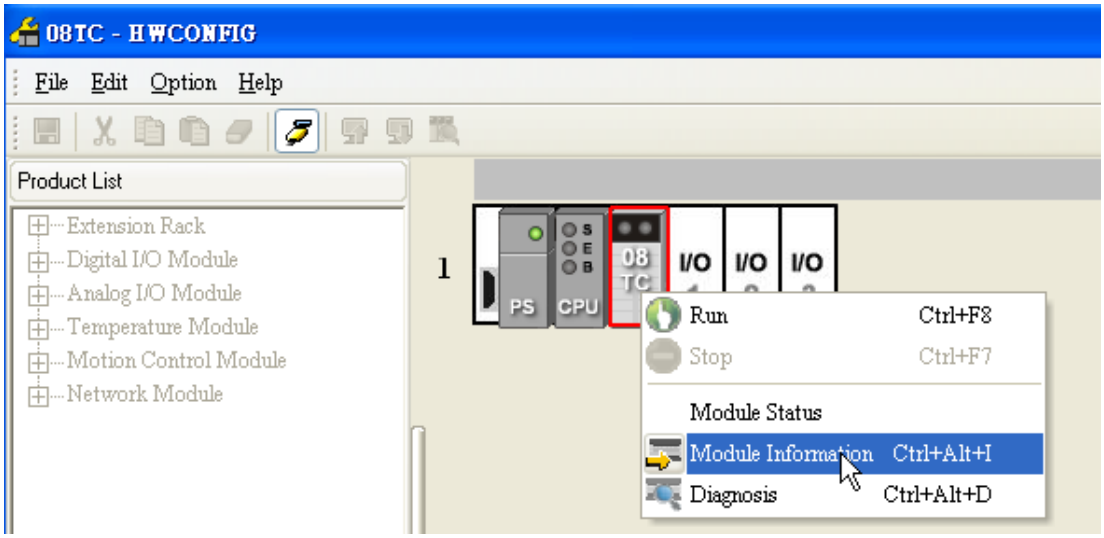


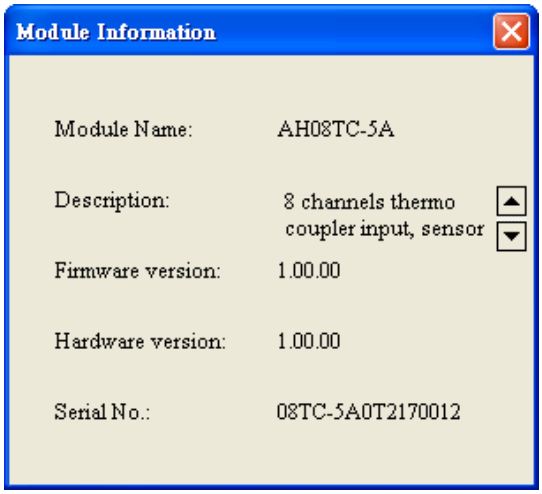
6.4.2 Checking the Version of a Module

(1) On the **Option** menu, click **Online Mode**.



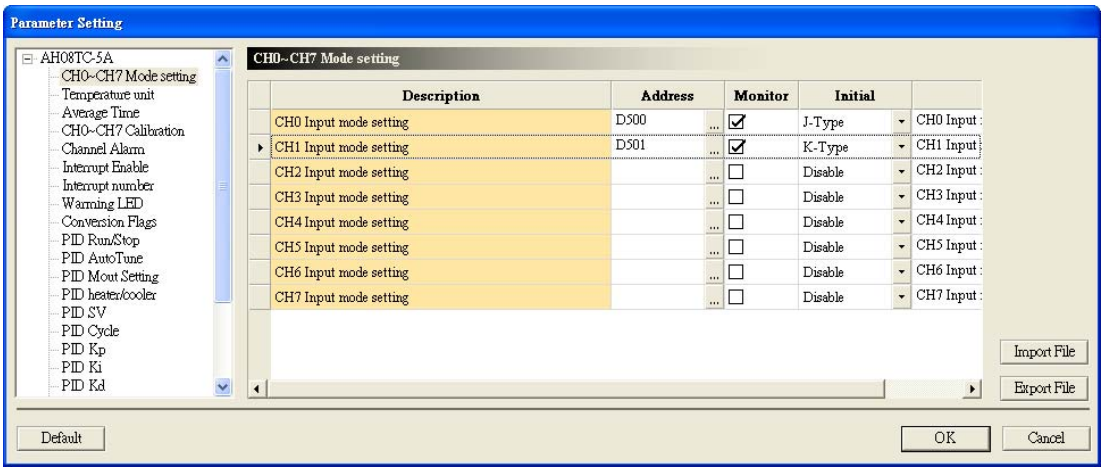
(2) Right-click the module, and then click **Module Information** on the context menu. The version of the firmware and that of the hardware are displayed.



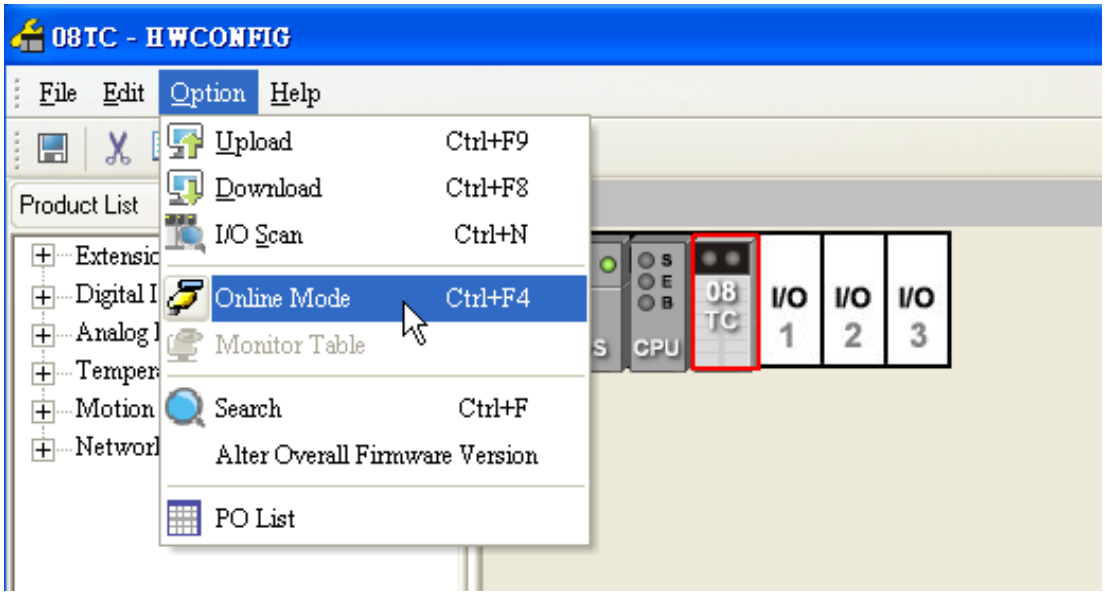


6.4.3 Monitoring Table

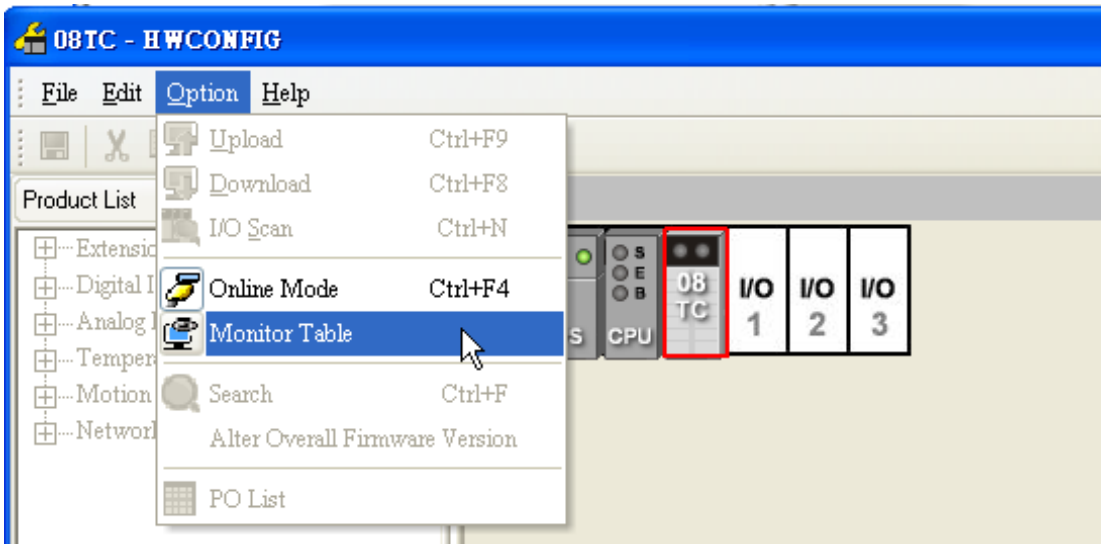
(1) Select the **Monitor** checkboxes at the right sides of the corresponding registers.

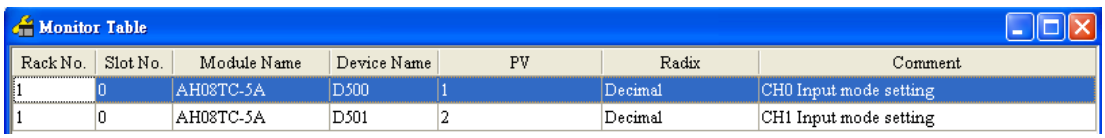


(2) On the **Option** menu, click **Online Mode**.



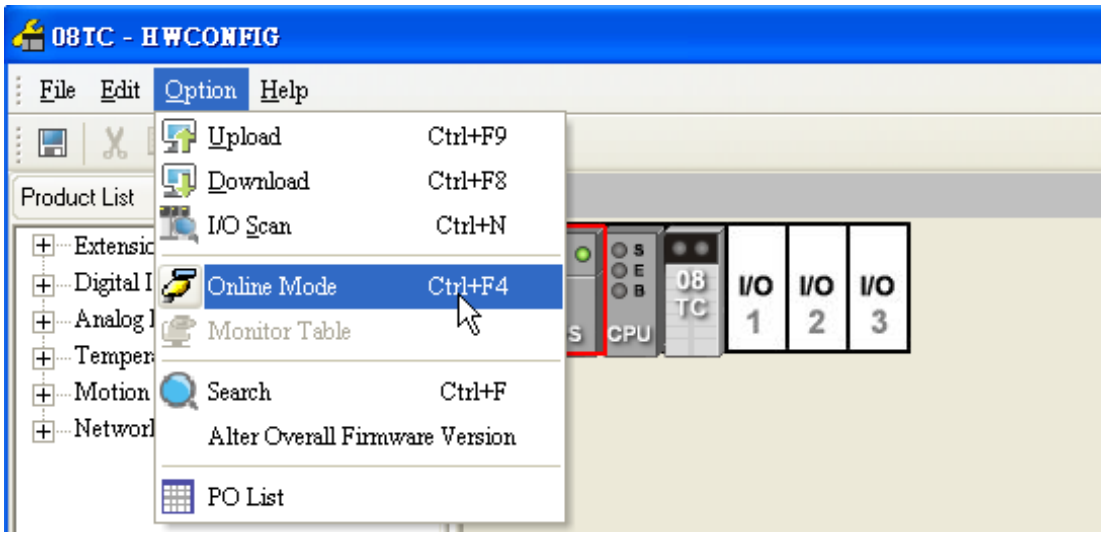
(3) On the **Option** menu, click **Monitor Table**. The registers are monitored.



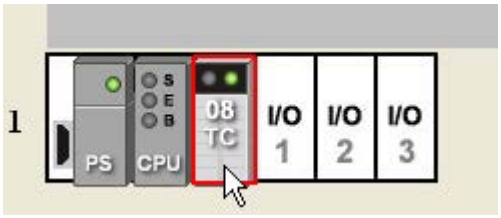

Monitor Table
Rack No. | Slot No. | Module Name | Device Name | PV | Radix | Comment
1 | 0 | AH08TC-5A | D500 | 1 | Decimal | CH0 Input mode setting
1 | 0 | AH08TC-5A | D501 | 2 | Decimal | CH1 Input mode setting

6.4.4 Online Mode

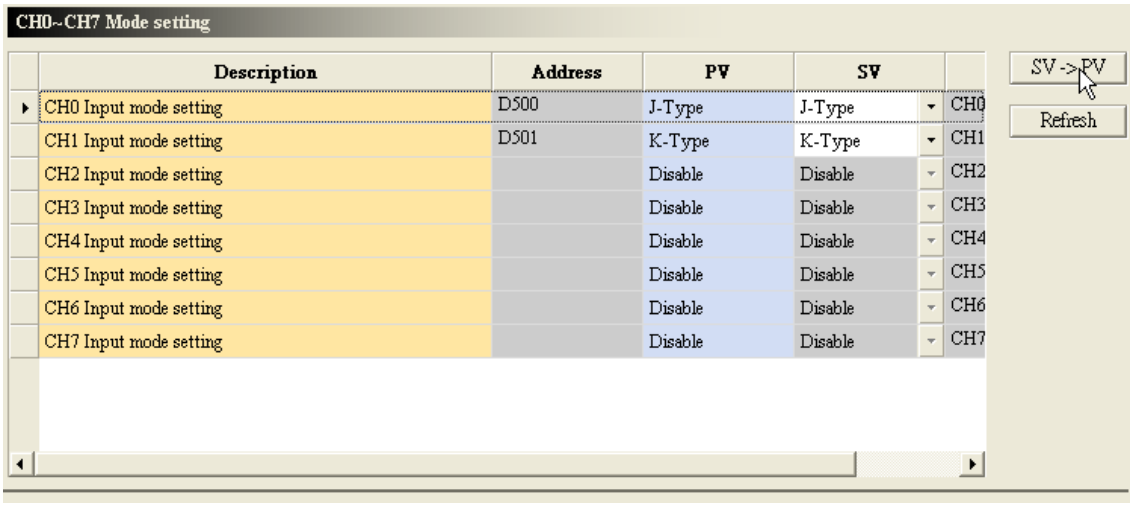
(1) Click **Online Mode** on the toolbar.



(2) Double-click the module.

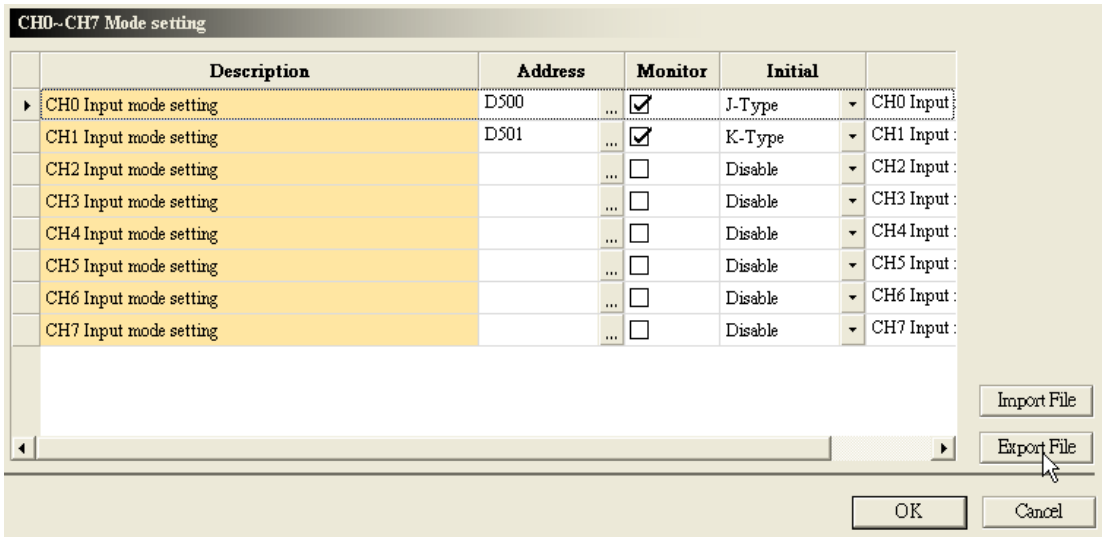


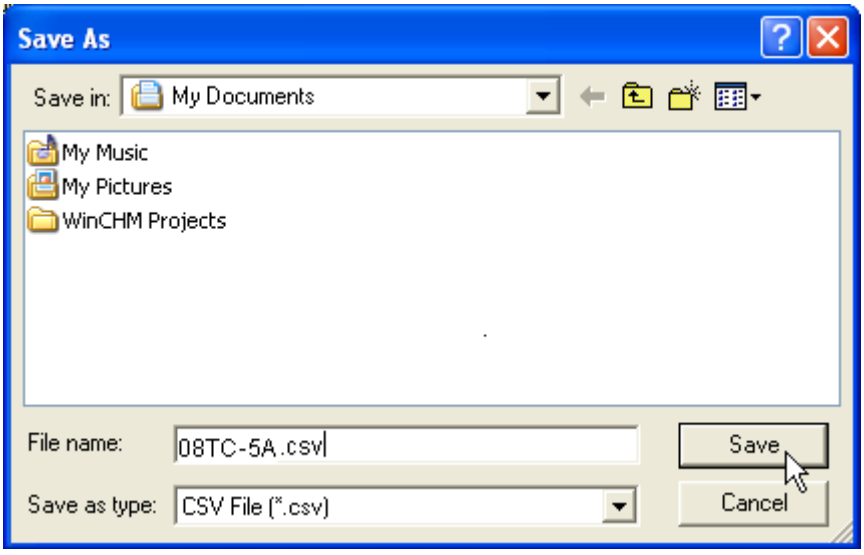
(3) If some parameters are altered, users can click **SV→PV**. The new setting values are written into the CPU module and the I/O module. If users want to read the present values in the I/O module, they can click **Update**. The present values in the I/O module are sent to ISPSoft, and are monitored.


CH0~CH7 Mode setting
Description
Address
PV
SV
SV->PV
Refresh
CH0 Input mode setting D500 J-Type J-Type CH0
CH1 Input mode setting D501 K-Type K-Type CH1
CH2 Input mode setting Disable Disable CH2
CH3 Input mode setting Disable Disable CH3
CH4 Input mode setting Disable Disable CH4
CH5 Input mode setting Disable Disable CH5
CH6 Input mode setting Disable Disable CH6
CH7 Input mode setting Disable Disable CH7

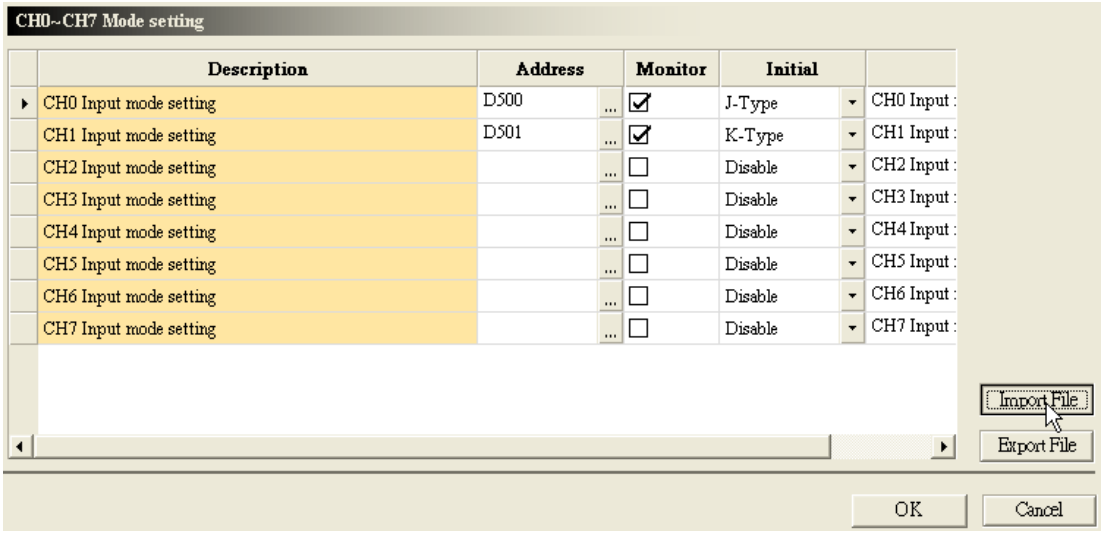
6.4.5 Importing/Exporting a Parameter File

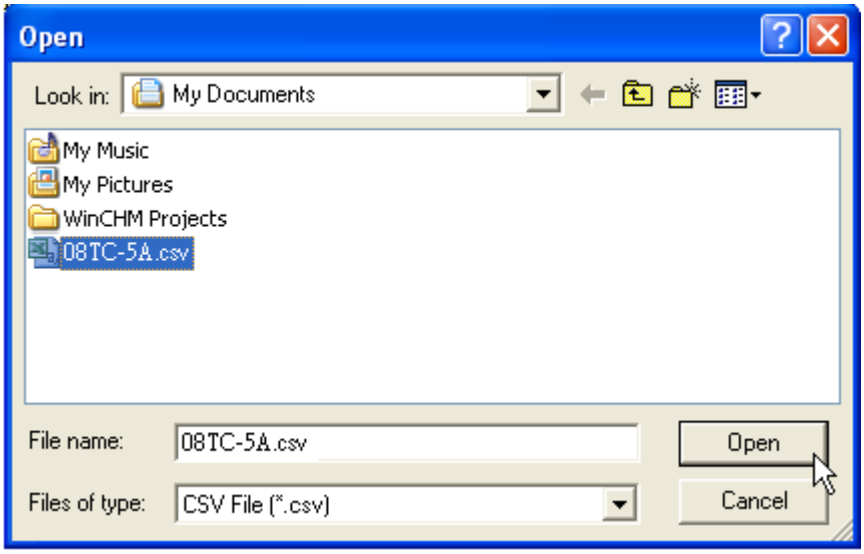
(1) After **Export** is clicked, the parameters will be saved as a CSV file (.csv).



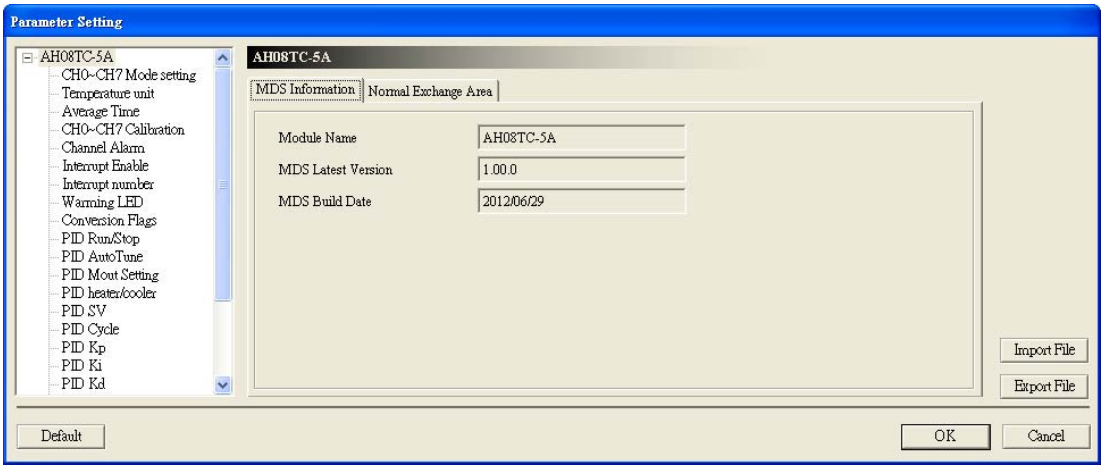


(2) Click **Import**, and then click the CSV file.

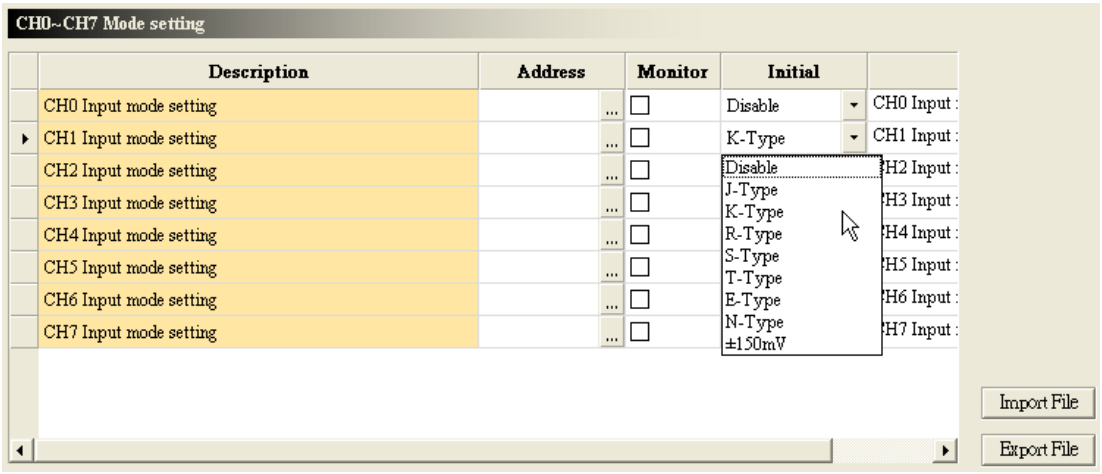




6.4.6 Parameters

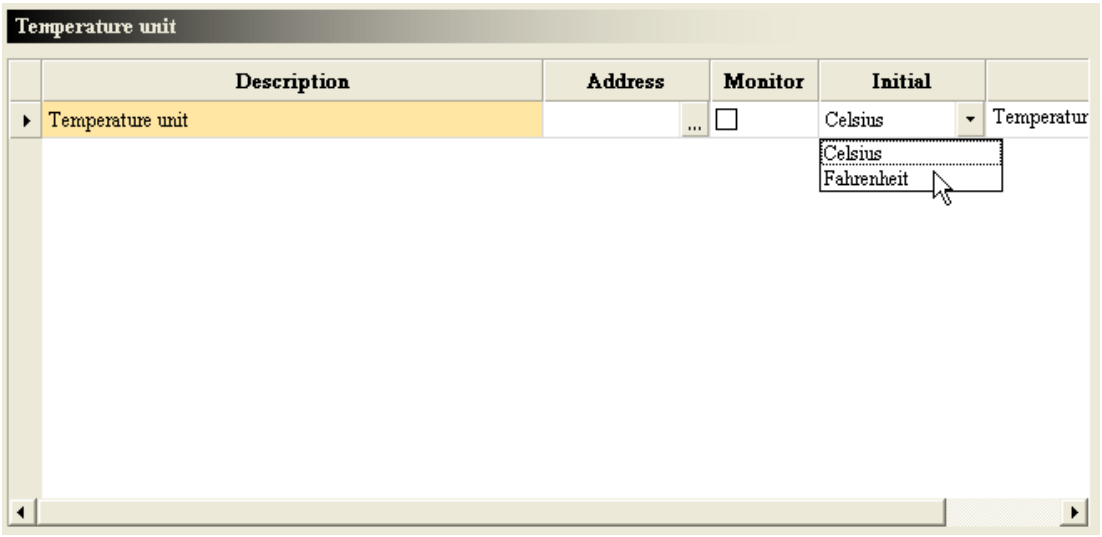


(1) The input modes of the channels



Description	0: The channel is disabled. 1: Type J thermocouple 2: Type K thermocouple 3: Type R thermocouple 4: Type S thermocouple 5: Type T thermocouple 6: Type E thermocouple 7: Type N thermocouple 8: ±150 mV voltage input

(2) Temperature unit (Celsius/Fahrenheit)



Description	K0: Celsius K1: Fahrenheit

(3) The number of values averaged

Average Time

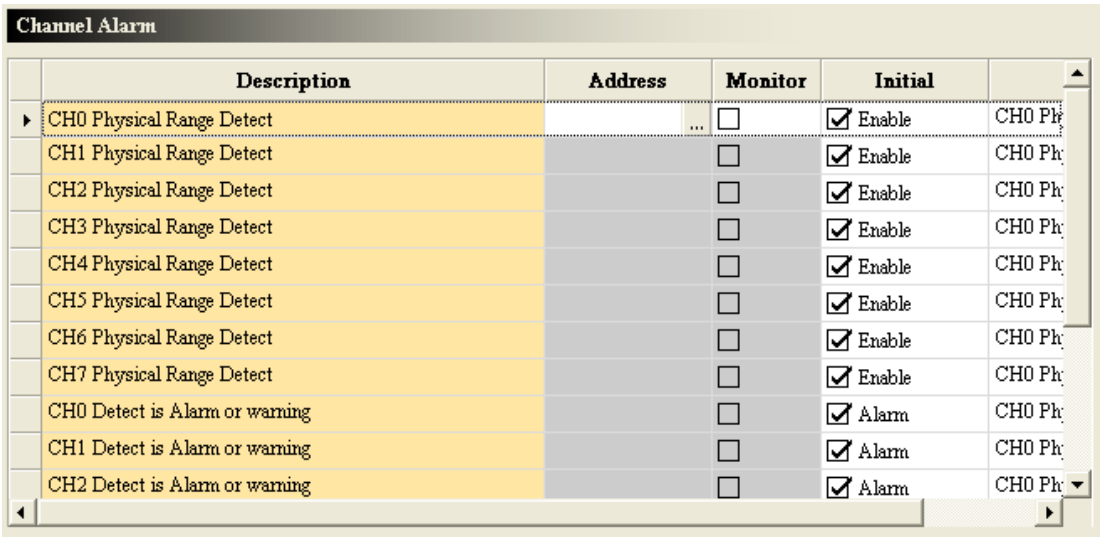
	Description	Address	Monitor	Initial	
▸	CH0 Average Time	...	☐	10	CH0 Avera
	CH1 Average Time	...	☐	10	CH1 Avera
	CH2 Average Time	...	☐	10	CH2 Avera
	CH3 Average Time	...	☐	10	CH3 Avera
	CH4 Average Time	...	☐	10	CH4 Avera
	CH5 Average Time	...	☐	10	CH5 Avera
	CH6 Average Time	...	☐	10	CH6 Avera
	CH7 Average Time	...	☐	10	CH7 Avera

(4) The offsets and the gains used for calibration

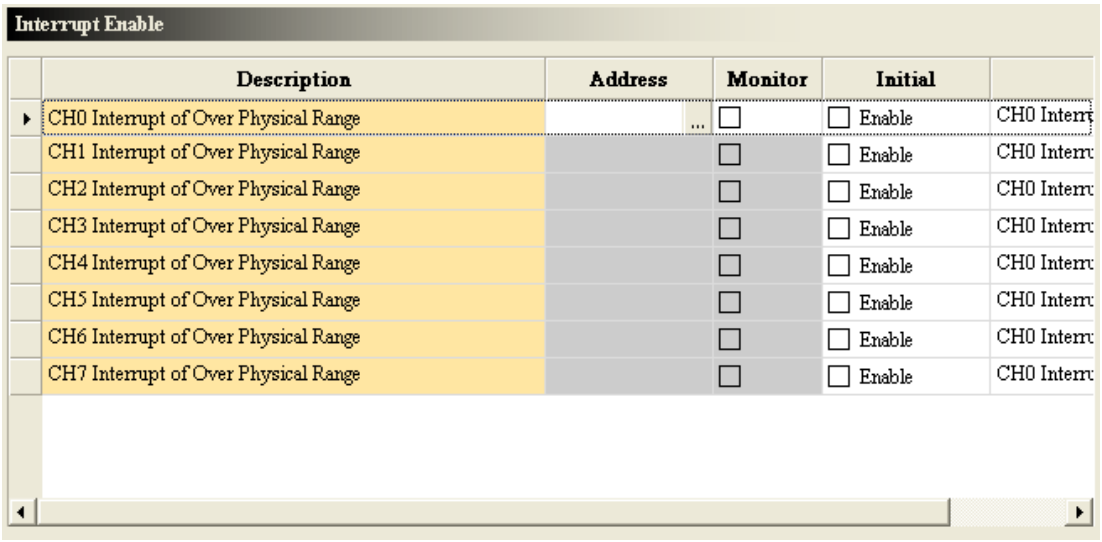
CH0~CH7 Calibration

	Description	Address	Monitor	Initial	
▸	CH0 Cal. Offset (℃/℉)	...	☐	0.000000	CH0 Ca
	CH1 Cal. Offset (℃/℉)	...	☐	0.000000	CH1 Ca
	CH2 Cal. Offset (℃/℉)	...	☐	0.000000	CH2 Ca
	CH3 Cal. Offset (℃/℉)	...	☐	0.000000	CH3 Ca
	CH4 Cal. Offset (℃/℉)	...	☐	0.000000	CH4 Ca
	CH5 Cal. Offset (℃/℉)	...	☐	0.000000	CH5 Ca
	CH6 Cal. Offset (℃/℉)	...	☐	0.000000	CH6 Ca
	CH7 Cal. Offset (℃/℉)	...	☐	0.000000	CH7 Ca
	CH0 Cal. Gain	...	☐	1.000000	CH0 Ca
	CH1 Cal. Gain	...	☐	1.000000	CH1 Ca
	CH2 Cal. Gain	...	☐	1.000000	CH2 Ca

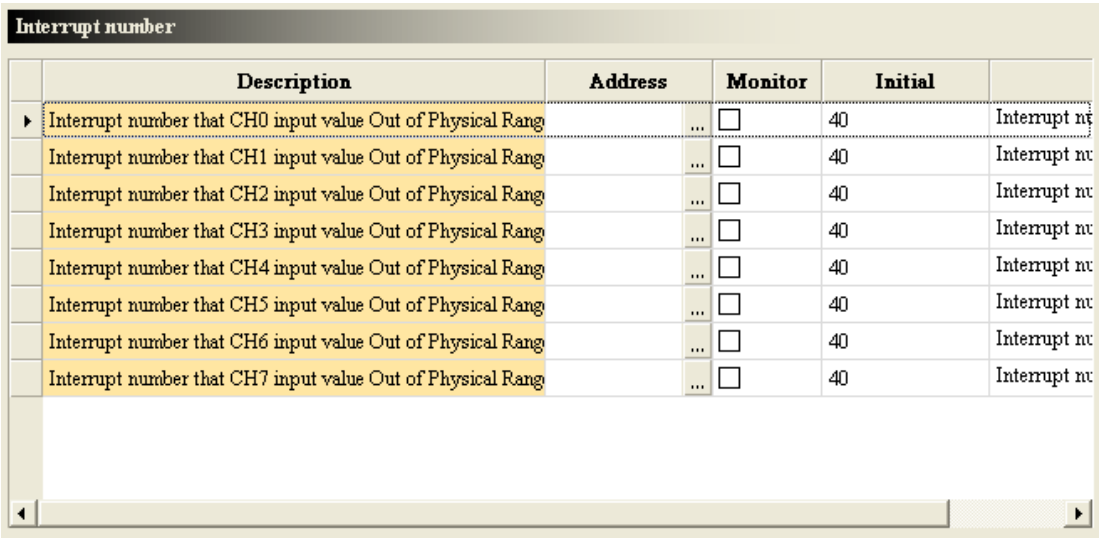
(5) The channel detection



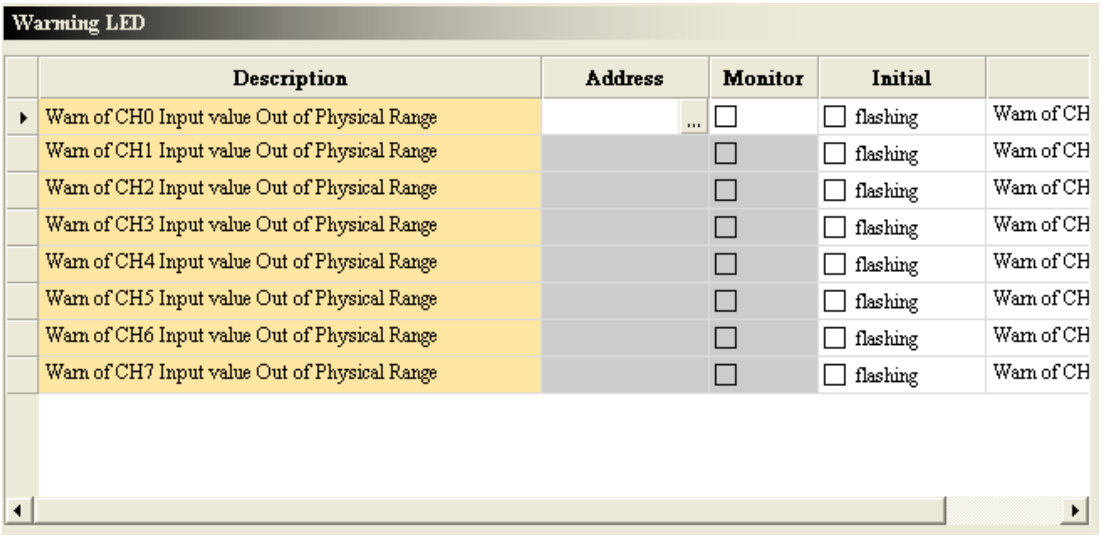
(6) Enabling the interrupts



(7) The interrupt numbers

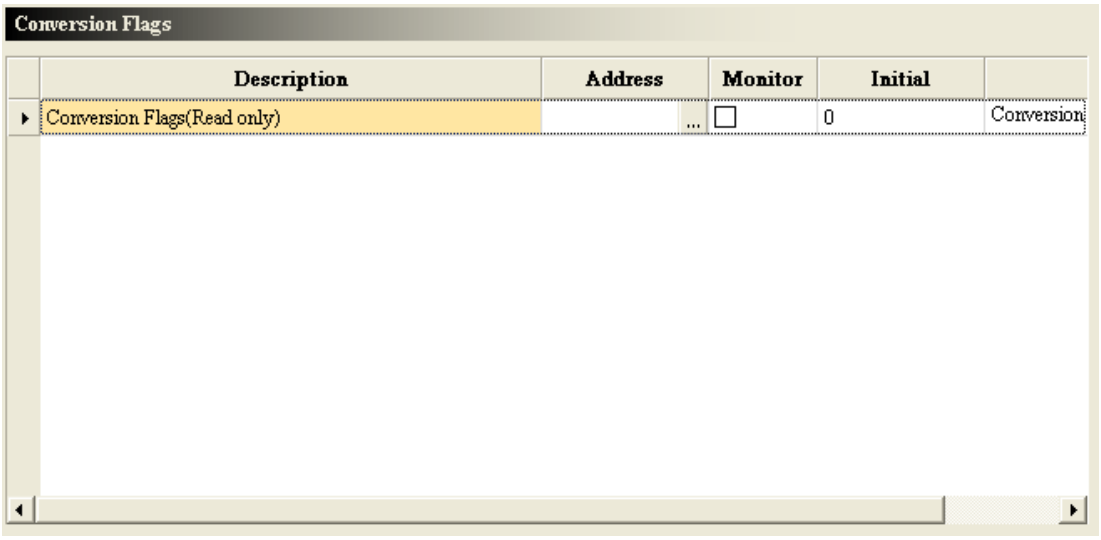

Interrupt number
Description
Address
Monitor
Initial
Interrupt number that CH0 input value Out of Physical Rang
Interrupt number that CH1 input value Out of Physical Rang
Interrupt number that CH2 input value Out of Physical Rang
Interrupt number that CH3 input value Out of Physical Rang
Interrupt number that CH4 input value Out of Physical Rang
Interrupt number that CH5 input value Out of Physical Rang
Interrupt number that CH6 input value Out of Physical Rang
Interrupt number that CH7 input value Out of Physical Rang
40

(8) Setting the warning LED indicator


Warning LED
Description
Address
Monitor
Initial
Warn of CH0 Input value Out of Physical Range
Warn of CH1 Input value Out of Physical Range
Warn of CH2 Input value Out of Physical Range
Warn of CH3 Input value Out of Physical Range
Warn of CH4 Input value Out of Physical Range
Warn of CH5 Input value Out of Physical Range
Warn of CH6 Input value Out of Physical Range
Warn of CH7 Input value Out of Physical Range
flashing

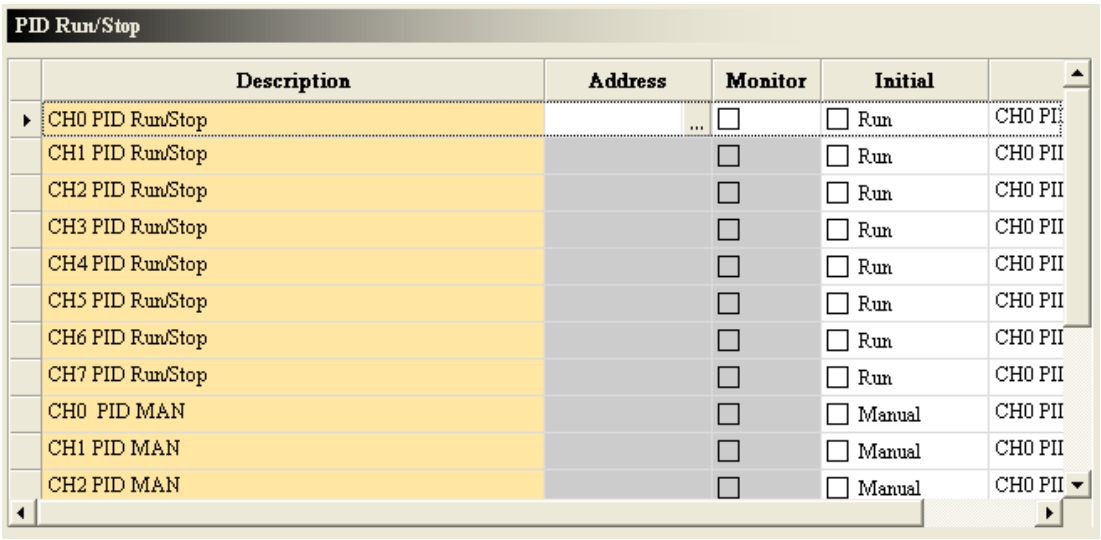
Description	bit0~bit7: CH0~CH7 (Warning LED indicator) (ON: Flash; OFF: Not flash)

(9) The error codes

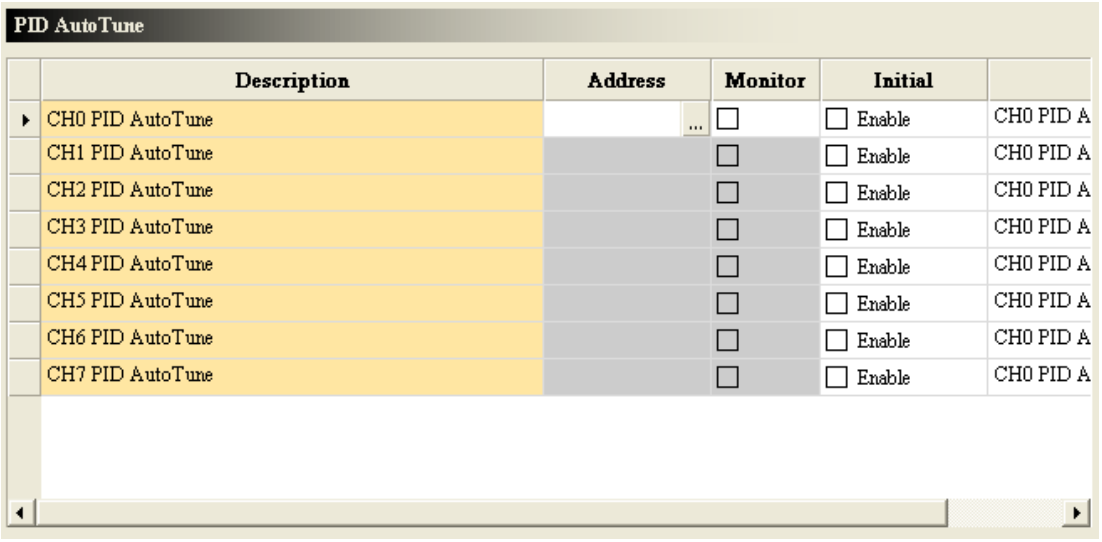


Description	bit0~bit7: The signals received by CH0~CH7 exceed the range of inputs which can be received by the hardware. bit15: The external voltage is abnormal.

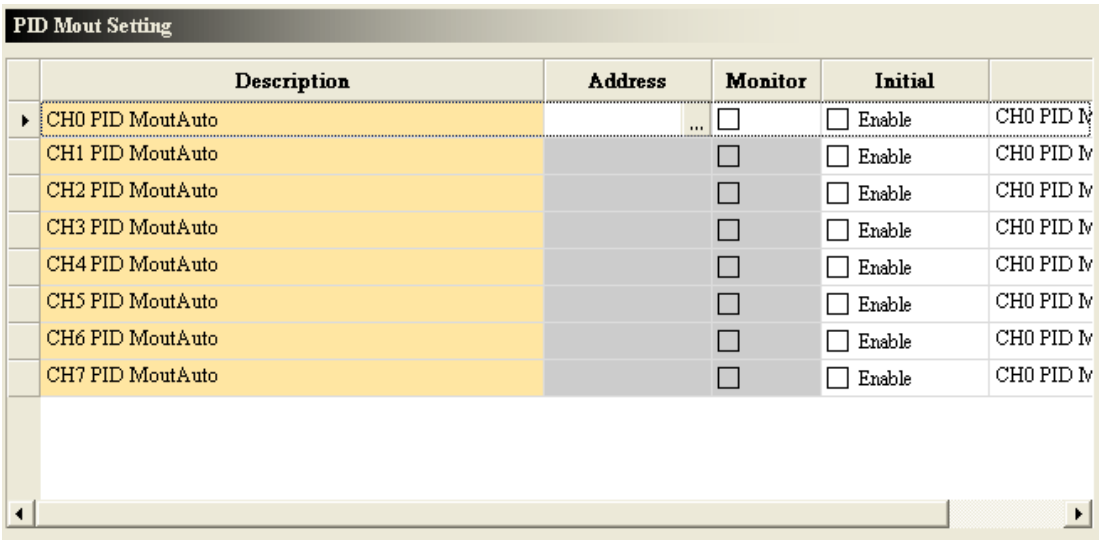
(10) Performing/Not performing the PID algorithm



(11) The automatic tuning



(12) Refreshing the manual output values automatically



(13) The heating/cooling mode

PID heater/cooler

	Description	Address	Monitor	Initial	
▸	CH0 PID Heater/Cooler	...	☐	☐ Cooler	CH0 PID H
	CH1 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH2 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH3 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH4 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH5 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH6 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H
	CH7 PID Heater/Cooler		☐	☐ Cooler	CH0 PID H

(14) The target values

PID SV

	Description	Address	Monitor	Initial	
▸	CH0 SV	...	☐	0.000000	CH0 SV
	CH1 SV	...	☐	0.000000	CH1 SV
	CH2 SV	...	☐	0.000000	CH2 SV
	CH3 SV	...	☐	0.000000	CH3 SV
	CH4 SV	...	☐	0.000000	CH4 SV
	CH5 SV	...	☐	0.000000	CH5 SV
	CH6 SV	...	☐	0.000000	CH6 SV
	CH7 SV	...	☐	0.000000	CH7 SV

(15) The sampling time

PID Cycle

	Description	Address	Monitor	Initial	
▸	CH0 Cycle	...	☐	10	CH0 Cycle
	CH1 Cycle	...	☐	10	CH1 Cycle
	CH2 Cycle	...	☐	10	CH2 Cycle
	CH3 Cycle	...	☐	10	CH3 Cycle
	CH4 Cycle	...	☐	10	CH4 Cycle
	CH5 Cycle	...	☐	10	CH5 Cycle
	CH6 Cycle	...	☐	10	CH6 Cycle
	CH7 Cycle	...	☐	10	CH7 Cycle

(16) The proportional gains

PID Kp

	Description	Address	Monitor	Initial	
▸	CH0 Kp	...	☐	0.000000	CH0 Kp
	CH1 Kp	...	☐	0.000000	CH1 Kp
	CH2 Kp	...	☐	0.000000	CH2 Kp
	CH3 Kp	...	☐	0.000000	CH3 Kp
	CH4 Kp	...	☐	0.000000	CH4 Kp
	CH5 Kp	...	☐	0.000000	CH5 Kp
	CH6 Kp	...	☐	0.000000	CH6 Kp
	CH7 Kp	...	☐	0.000000	CH7 Kp

(17) The integral gains

PID Ki

	Description	Address	Monitor	Initial	
▸	CH0 Ki	...	☐	0.000000	CH0 Ki
	CH1 Ki	...	☐	0.000000	CH1 Ki
	CH2 Ki	...	☐	0.000000	CH2 Ki
	CH3 Ki	...	☐	0.000000	CH3 Ki
	CH4 Ki	...	☐	0.000000	CH4 Ki
	CH5 Ki	...	☐	0.000000	CH5 Ki
	CH6 Ki	...	☐	0.000000	CH6 Ki
	CH7 Ki	...	☐	0.000000	CH7 Ki

(18) The derivative gains

PID Kd

	Description	Address	Monitor	Initial	
▸	CH0 Kd	...	☐	0.000000	CH0 Kd
	CH1 Kd	...	☐	0.000000	CH1 Kd
	CH2 Kd	...	☐	0.000000	CH2 Kd
	CH3 Kd	...	☐	0.000000	CH3 Kd
	CH4 Kd	...	☐	0.000000	CH4 Kd
	CH5 Kd	...	☐	0.000000	CH5 Kd
	CH6 Kd	...	☐	0.000000	CH6 Kd
	CH7 Kd	...	☐	0.000000	CH7 Kd

(19) The range within which the error values are count as 0

PID ERR_DBW

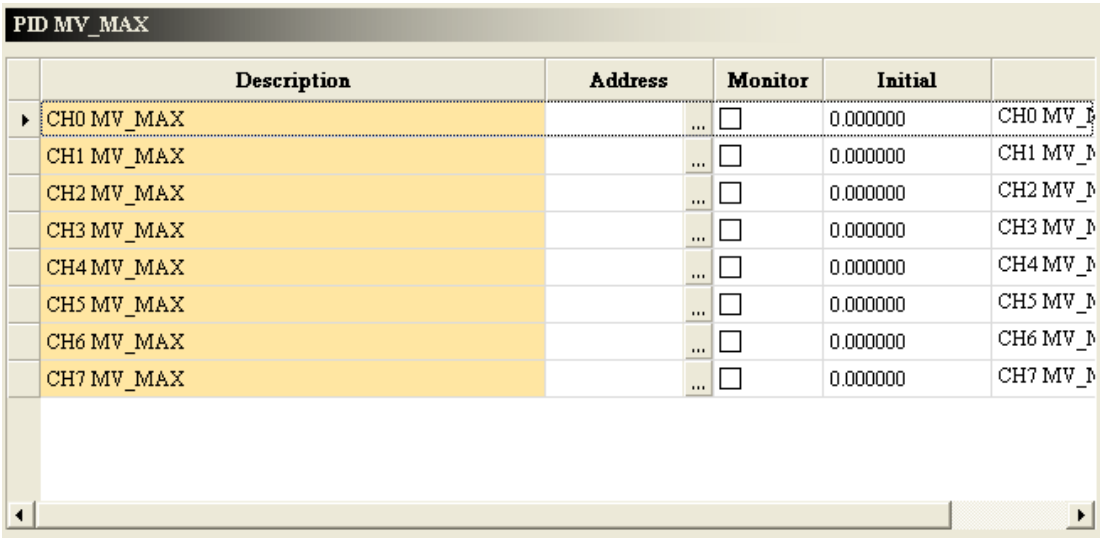
	Description	Address	Monitor	Initial	
▸	CH0 ERR_DBW	...	☐	0.000000	CH0 ERR_
	CH1 ERR_DBW	...	☐	0.000000	CH1 ERR_
	CH2 ERR_DBW	...	☐	0.000000	CH2 ERR_
	CH3 ERR_DBW	...	☐	0.000000	CH3 ERR_
	CH4 ERR_DBW	...	☐	0.000000	CH4 ERR_
	CH5 ERR_DBW	...	☐	0.000000	CH5 ERR_
	CH6 ERR_DBW	...	☐	0.000000	CH6 ERR_
	CH7 ERR_DBW	...	☐	0.000000	CH7 ERR_

(20) The manual output values

PID MOUT

	Description	Address	Monitor	Initial	
▸	CH0 MOUT	...	☐	0.000000	CH0 MOU
	CH1 MOUT	...	☐	0.000000	CH1 MOU
	CH2 MOUT	...	☐	0.000000	CH2 MOU
	CH3 MOUT	...	☐	0.000000	CH3 MOU
	CH4 MOUT	...	☐	0.000000	CH4 MOU
	CH5 MOUT	...	☐	0.000000	CH5 MOU
	CH6 MOUT	...	☐	0.000000	CH6 MOU
	CH7 MOUT	...	☐	0.000000	CH7 MOU

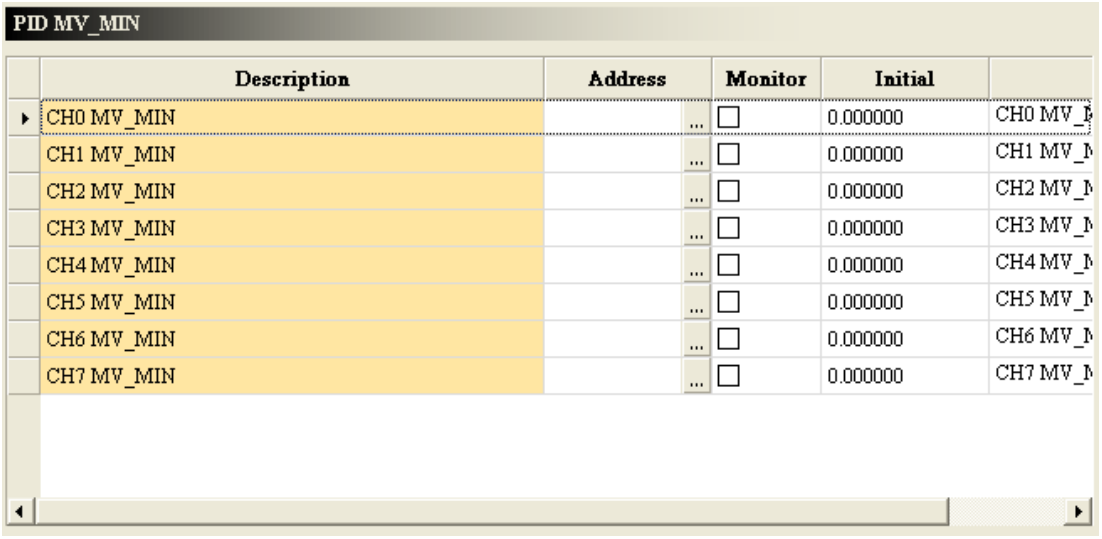
(21) The maximum output values



PID MV_MAX

	Description	Address	Monitor	Initial	
▸	CH0 MV_MAX	...	☐	0.000000	CH0 MV_
	CH1 MV_MAX	...	☐	0.000000	CH1 MV_
	CH2 MV_MAX	...	☐	0.000000	CH2 MV_
	CH3 MV_MAX	...	☐	0.000000	CH3 MV_
	CH4 MV_MAX	...	☐	0.000000	CH4 MV_
	CH5 MV_MAX	...	☐	0.000000	CH5 MV_
	CH6 MV_MAX	...	☐	0.000000	CH6 MV_
	CH7 MV_MAX	...	☐	0.000000	CH7 MV_

(22) The minimum output values



PID MV_MIN

	Description	Address	Monitor	Initial	
▸	CH0 MV_MIN	...	☐	0.000000	CH0 MV_
	CH1 MV_MIN	...	☐	0.000000	CH1 MV_
	CH2 MV_MIN	...	☐	0.000000	CH2 MV_
	CH3 MV_MIN	...	☐	0.000000	CH3 MV_
	CH4 MV_MIN	...	☐	0.000000	CH4 MV_
	CH5 MV_MIN	...	☐	0.000000	CH5 MV_
	CH6 MV_MIN	...	☐	0.000000	CH6 MV_
	CH7 MV_MIN	...	☐	0.000000	CH7 MV_

(23) Reading the output values

PID MV(Read only)

	Description	Address	Monitor	Initial	
▸	CH0 MV(Read only)	...	☐	0.000000	CH0 MV(R
	CH1 MV(Read only)	...	☐	0.000000	CH1 MV(R
	CH2 MV(Read only)	...	☐	0.000000	CH2 MV(R
	CH3 MV(Read only)	...	☐	0.000000	CH3 MV(R
	CH4 MV(Read only)	...	☐	0.000000	CH4 MV(R
	CH5 MV(Read only)	...	☐	0.000000	CH5 MV(R
	CH6 MV(Read only)	...	☐	0.000000	CH6 MV(R
	CH7 MV(Read only)	...	☐	0.000000	CH7 MV(R

(24) The accumulated integral values

PID I_MV(Read only)

	Description	Address	Monitor	Initial	
▸	CH0 I_MV(Read only)	...	☐	0.000000	CH0 I_MV
	CH1 I_MV(Read only)	...	☐	0.000000	CH1 I_MV
	CH2 I_MV(Read only)	...	☐	0.000000	CH2 I_MV
	CH3 I_MV(Read only)	...	☐	0.000000	CH3 I_MV
	CH4 I_MV(Read only)	...	☐	0.000000	CH4 I_MV
	CH5 I_MV(Read only)	...	☐	0.000000	CH5 I_MV
	CH6 I_MV(Read only)	...	☐	0.000000	CH6 I_MV
	CH7 I_MV(Read only)	...	☐	0.000000	CH7 I_MV

6.5 Troubleshooting

6.5.1 Error Codes

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A600	Alarm	Hardware failure	OFF	ON
16#A601	Alarm	The external voltage is abnormal.	OFF	ON
16#A602	Alarm	Internal error The CJC is abnormal.	OFF	ON
16#A603	Alarm	Internal error The factory correction is abnormal.	OFF	ON
16#A400	Alarm	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A401	Alarm	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A402	Alarm	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A403	Alarm	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A404	Alarm	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A405	Alarm	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A406	Alarm	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A407	Alarm	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	OFF	ON
16#A000	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A001	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A002	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A003	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A004	Warning	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A005	Warning	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	ON	Blink

Error Code	Type	Description	RUN LED indicator	ERROR LED indicator
16#A006	Warning	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A007	Warning	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	ON	Blink
16#A800	Warning	The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A801	Warning	The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A802	Warning	The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A803	Warning	The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A804	Warning	The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A805	Warning	The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A806	Warning	The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	ON	OFF
16#A807	Warning	The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	ON	OFF

6.5.2 Troubleshooting Procedure

Description	Procedure
Hardware failure	Return the module to the factory for repair.
The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.
Internal error The CJC is abnormal.	Please contact the factory.
Internal error The factory correction is abnormal.	Please contact the factory.
The signal received by channel 0 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 0.
The signal received by channel 1 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 1
The signal received by channel 2 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 2.

Description	Procedure
The signal received by channel 3 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 3.
The signal received by channel 4 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 4.
The signal received by channel 5 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 5.
The signal received by channel 6 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 6.
The signal received by channel 7 exceeds the range of inputs which can be received by the hardware.	Check the signal received by channel 7.

MEMO

Chapter 7 Network Module AH10DNET-5A

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7.1 Introduction

AH10DNET-5A is installed at the right side of an AH500 series CPU module. AH10DNET-5A and an AH500 series CPU module constitute the DeviceNet master or slave.

7.1.1 Feature

- Constitutes the DeviceNet master by connecting to an AH500 series CPU module and supports DeviceNet protocol.
- The network configuration software DeviceNet Builder provides the handy graphical configuration interface and automatically scans and recognizes all slaves on the bus.
- Supports DeviceNet master and slave mode.
- An AH500 series CPU module could be expanded by connecting 8 AH10DNET-5A scanner modules.
- Supporting 8 transmission speeds: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps and 1M kbps.

7.1.2 Function

AH10DNET-5A can be used as DeviceNet master as well as slave.

As a master, AH10DNET-5A can provide the following function.

- Automatically performing the data exchange with an AH500 series CPU module; users can directly operate the specified register in an AH500 series CPU module to achieve the real-time monitor of the slave.
- The configuration software can configure the network via the module as AH10DNET-5A serves as the connection medium between DeviceNet Builder configuration software and DeviceNet network.
- Supports to send the explicit message to monitor the slave through PLC program.
- The maximum input and output data length are both 980 bytes.

As a slave, AH10DNET-5A can provide the following function.

- Automatically performing the data exchange with an AH500 series CPU module; users can directly operate the specified register in an AH500 series CPU module to gain the control data of the master and return the corresponding data to the master.
- The maximum input and output data length are both 1000 bytes.

7.1.3 Specifications

- **AH500 series CPU modules which are supported**

Item	Specifications
Model name	AH500 series PLCs

- **DeviceNet interface**

Item	Specifications
Transmission method	CAN
Electrical isolation	500 V DC
Connector	Removable connector (5.08 mm)
Communication cable	Recommend to use Delta standard cable; TAP-CB01 and TAP-CB02. The communication cable should be away from the power cable and the shielded cable should be connected to the ground.
Voltage	DeviceNet network provides 11~25 V direct current. e.g. 28 mA (Typical value), 125 mA impulse current (24 V DC).

- **DeviceNet Communication**

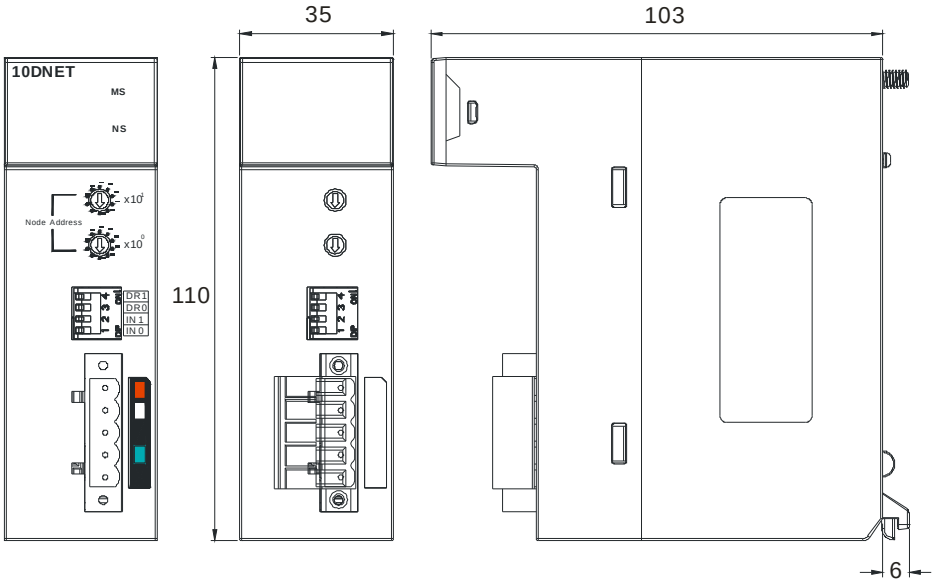
Item	Specifications
Message type	Master mode: Support explicit message, all kinds of I/O connection with the slave such as I/O polled, bit-strobe, state changing, cyclic Slave mode: Support explicit message and Group 2 only server
Transmission speed	Standard: 125 kbps, 250 kbps and 500 kbps Extension: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800kbps and 1M bps

- **Environment**

Item	Specifications
Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8 KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line:2KV, Digital I/O: 1 KV Analog & Communication I/O: 1 KV Damped-Oscillatory Wave: Power Line:1 KV, Digital I/O: 1 KV RS (IEC 61131-2, IEC 61000-4-3): 26 MHz~1 GHz, 10 V/m
Operation temperature	0ºC~55ºC (Temperature), 50~95% (Humidity), pollution level 2
Storage temperature	-25ºC~70ºC (Temperature), 5~95% (Humidity)
Vibration/Shock resistance	International standard IEC 61131-2, IEC 68-2-6 (TEST Fc)/IEC 61131-2 & IEC 68-2-27 (TEST Ea)
Certifications	IEC 61131-2, UL508

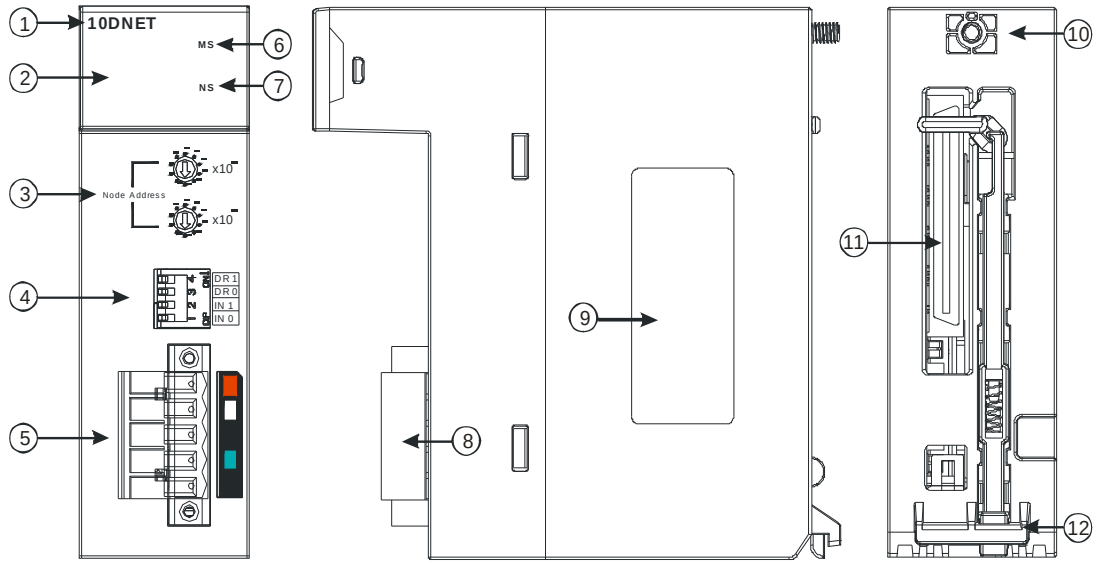
7.2 Profile and Outline

7.2.1 Profile and Dimension



Unit: mm

7.2.2 Parts

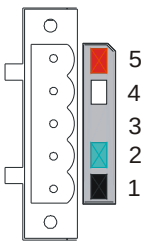


Number	Name	Description
1	Model name	The name of the module
2	Seven-segment displayer	A displayer
3	Address switch	For setting the address
4	Function switch	For setting the function
5	DeviceNet connection port	For DeviceNet connection
6	MS indicator	An indicator
7	NS indicator	An indicator
8	Removable terminal	The terminal for wiring
9	Label	Nameplate
10	Set screw	Fixing the module
11	Backplane interface	The connector is used to connect the module and the backplane.
12	Projection	Fixing the module

7.2.3 DeviceNet Communication Connector

The connector is used on the connection to DeviceNet. Wire by using the connector enclosed with AH10DNET-5A.

Pin	Signal	Color	Description
5	V+	Red	24 VDC
4	CAN_H	White	Signal+
3	-	-	Shielded wire
2	CAN_L	Blue	Signal-
1	V-	Black	0 VDC



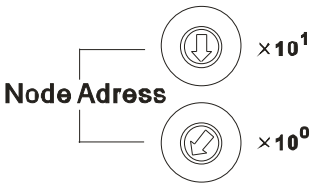
Note:

1. Connect the 24 V DC network power supply between V+ and V-.
2. One 121 ohm terminal resistor may be needed to connect between white and blue signal wires. For more details, please refer to section 7.3.4.

7.2.4 Address Switch

The switch is used on setting up the node address of AH10DNET-5A on DeviceNet. Range: 00~63 (64~99 are forbidden).

Switch setting	Description
0-63	Valid DeviceNet node address
64-99	Invalid DeviceNet node address



Example: If you need to set the node address of AH10DNET-5A to 26, simply switch the corresponding switch of $x10^1$ to 2 and the corresponding switch of $x10^0$ to 6.

Note:

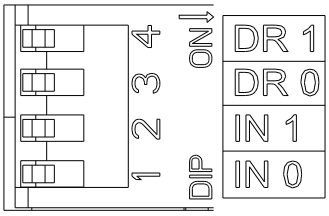
1. After the setup is completed, re-power AH10DNET-5A. While AH10DNET-5A is working, changing the setting of node address will be invalid.
2. Use the slotted screwdriver to rotate the switch carefully in case you scratch the switch.

7.2.5 Function Switch

The function switches are used for:

- Setting up the work mode (IN0)
- Setting up the baud rate of DeviceNet (DR0~DR1)

DR1	DR0	Baud rate	Max. transmission distance
OFF	OFF	125 kbps	500 m
OFF	ON	250 kbps	250 m
ON	OFF	500 kbps	100 m
ON	ON	Entering the mode of extended baud rate.(See section 7.7.3 and 7.8.3.)	



IN0	ON	When the corresponding equipment is off-line, the I/O data in the buffer area will be held.
	OFF	When the corresponding equipment is off-line, the I/O data in the buffer area will be cleared.
IN1	Reserved	

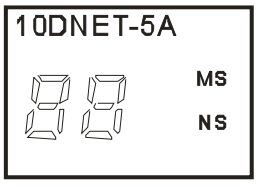
Note:

1. After the setup of the function switch including DR1, DR0 and IN0 is completed, re-power AH10DNET-5A.
2. Use slotted screwdriver to adjust the DIP switch carefully in case you scratch the switch.

7.2.6 Seven-segment Displayer

The digital displayer provides the following function:

- Showing the node station number of AH10DNET-5A
- Showing the error message of the slave



Note:

1. While AH10DNET-5A is working normally, the digital displayer shows its own node address.
2. If “E1” and “03” are shown continuously, it indicates that the error of E1 exists in the slave of node address 03.
3. If the error codes such as “E7” and “E1” are shown, please refer to section 7.10.2 for treatment.

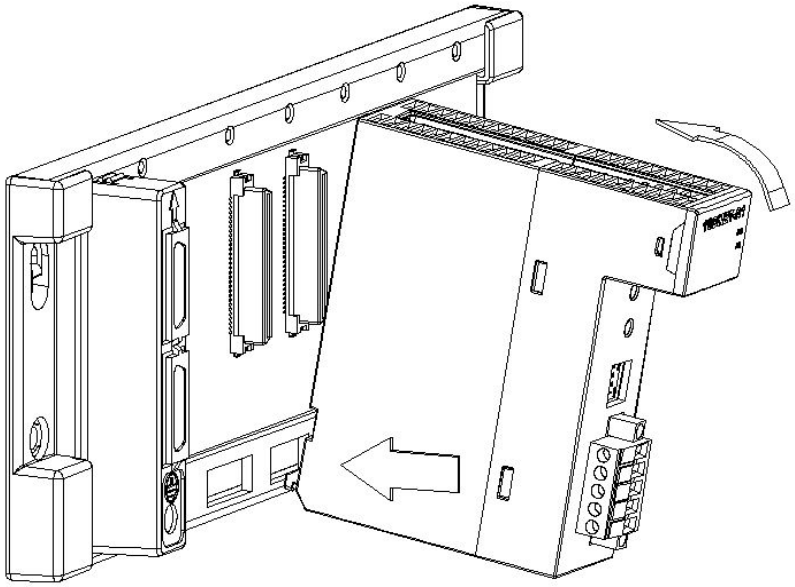
7.2.7 Backplane Interface

The interface is used for connection between AH10DNET-5A and a backplane.

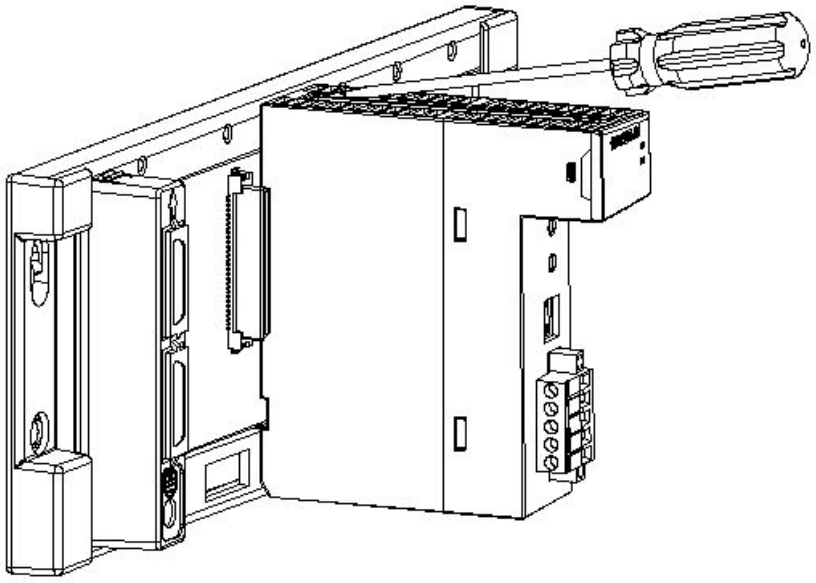
7.3 Installation

7.3.1 Installing the Module

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the following arrow to meet the I/O slot of the backplane.

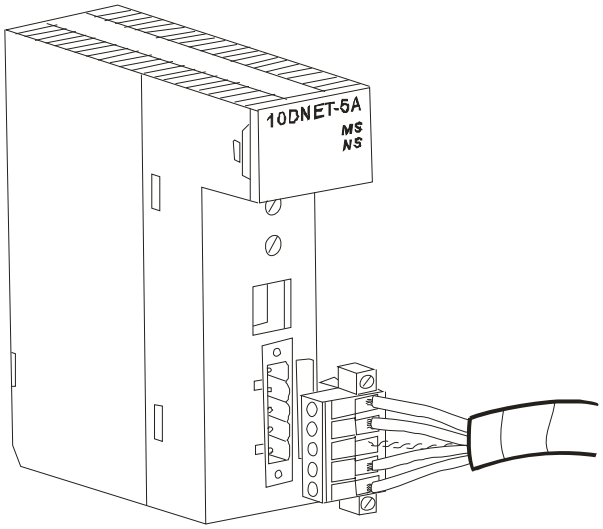


3. After properly installing, tighten the screw on the upper of the module.



7.3.2 Connecting to the DeviceNet Communication Connector

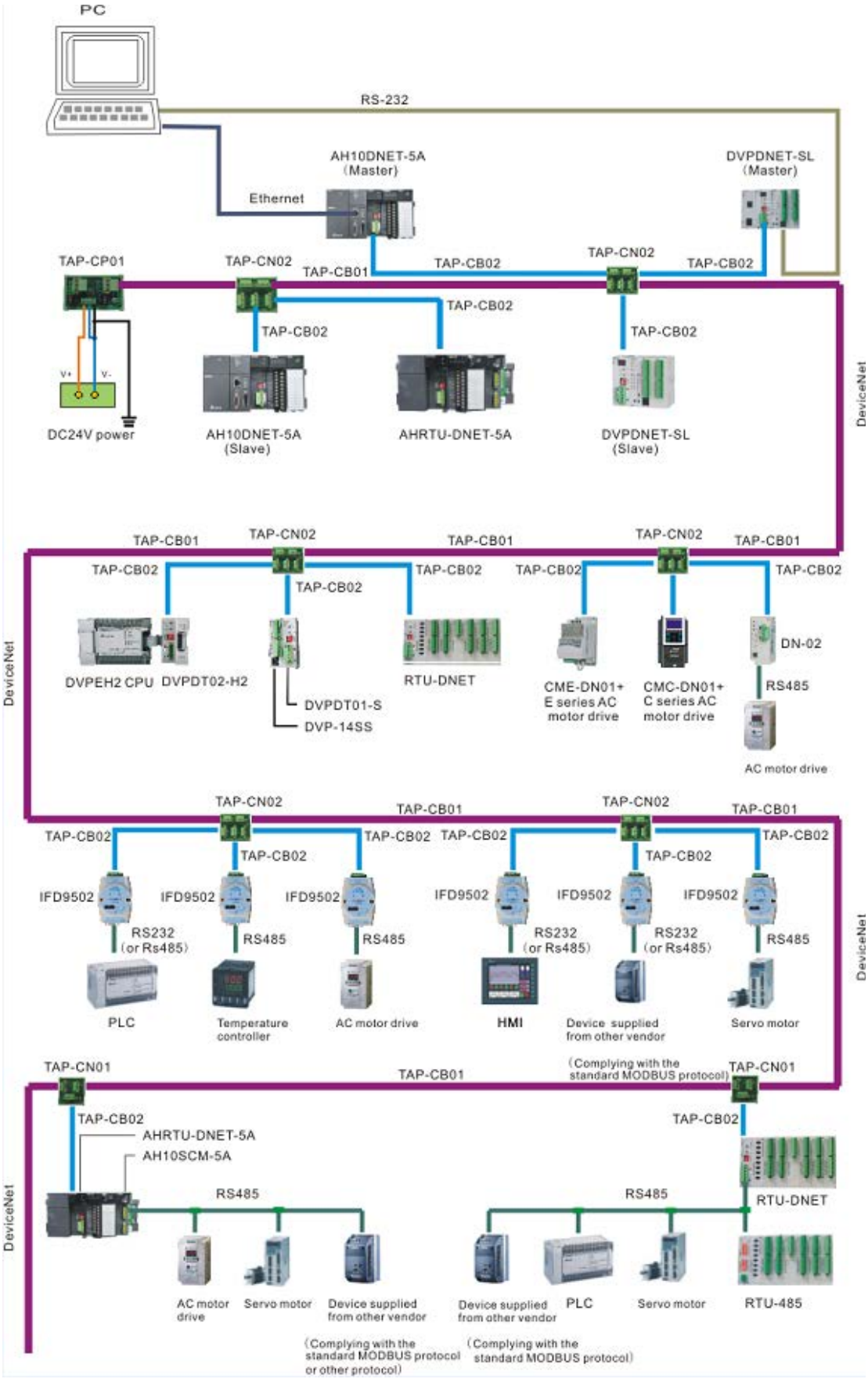
1. After wiring is completed, insert the DeviceNet connector to the port.
2. Tighten the screws on two sides of the DeviceNet terminal.



7.3.3 DeviceNet Bus Network Topology Structure

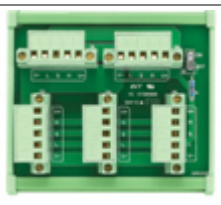
The transmission distance on the DeivceNet bus network is determined by the transmission rate. The following table shows the corresponding maximum communication distance at different transmission rates.

Transmission rate (Bit/s)	10K	20K	50K	125K	250K	500K	800K	1M
Max. Communication distance (M)	5000	2500	1000	500	250	100	50	25


PC
RS-232
AH10DNET-5A
(Master)
Ethernet
DVPDNET-SL
(Master)
TAP-CP01
TAP-CN02
TAP-CB01
TAP-CB02
TAP-CN02
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
V+
V-
DC24V power
AH10DNET-5A
(Slave)
AHRTU-DNET-5A
DVPDNET-SL
(Slave)
DeviceNet
TAP-CB01
TAP-CN02
TAP-CB01
TAP-CN02
TAP-CB01
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
DVPEH2 CPU
DVPDT02-H2
DVPDT01-S
DVP-14SS
RTU-DNET
CME-DN01+
E series AC
motor drive
CMC-DN01+
C series AC
motor drive
DN-02
RS485
AC motor drive
DeviceNet
TAP-CN02
TAP-CB01
TAP-CN02
TAP-CB01
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
TAP-CB02
IFD9502
IFD9502
IFD9502
IFD9502
IFD9502
IFD9502
RS232
(or Rs485)
RS485
RS485
RS232
(or Rs485)
RS232
(or Rs485)
RS485
PLC
Temperature
controller
AC motor drive
HMI
Device supplied
from other vendor
Servo motor
DeviceNet
TAP-CN01
TAP-CB01
(Complying with the
standard MODBUS protocol)
TAP-CN01
TAP-CB02
AHRTU-DNET-5A
AH10SCM-5A
TAP-CB02
RS485
RS485
RTU-DNET
AC motor
drive
Servo motor
Device supplied
from other vendor
Device supplied
from other vendor
PLC
Servo motor
RTU-485
(Complying with the
standard MODBUS protocol
or other protocol)
(Complying with the
standard MODBUS protocol)
DeviceNet

Delta network products related with DeviceNet bus:

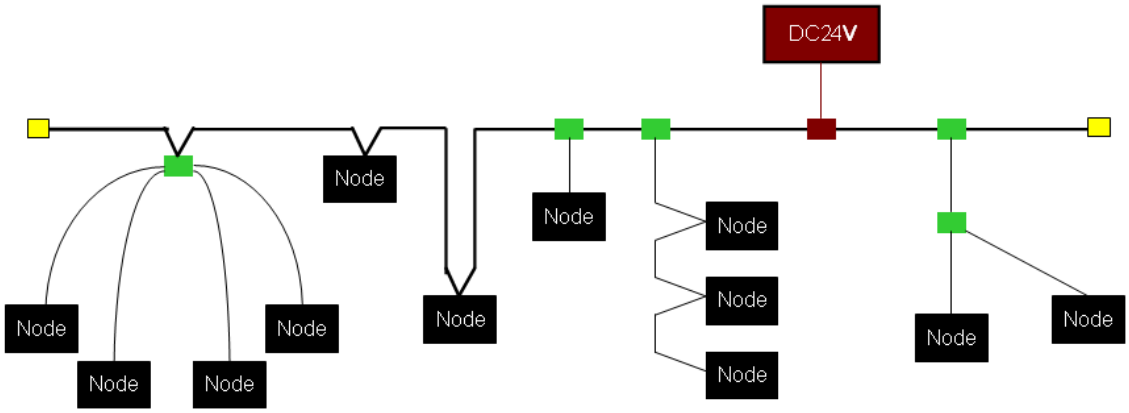
Product picture	Type	Function
	AH10DNET-5A	AH10DNET-5A, a DeviceNet module, running on the I/O slot of AH main backplane can work as the DeviceNet master or slave.
	AHRTU-DNET-5A	AHRTU-DNET-5A, a remote I/O module, is used for connecting AH series DI/DO module, AI/AO module and 10SCM module to the DeviceNet network.
	DVPDNET-SL	DVPDNET-SL, a DeviceNet module, running on the left of an S series PLC can work as the DeviceNet master or slave.
	RTU-DNET	RTU-DNET, a remote I/O module, is used for connecting S-series DI/DO module, AI/AO module and other device to the DeviceNet network.
	IFD9502	Used for connection between the DeviceNet network and electromechanical equipment such as AC motor drive, PLC, temperature controller, servo drive, HMI, user-defined device.
	IFD6503	The bus data analysis tool, with one end of CAN interface and the other end of USB interface can be used for getting the CAN bus data or sending the data to the CAN bus node. It is used with the Netview Builder software together.
	E series AC motor drive	Used for connecting the AC motor drive to the DeviceNet network via CME-DN01 card

Product picture	Type	Function
	CMC-DN01	Used for connecting the C2000-series AC motor drive to the DeviceNet network
	DN-02	Used for the connection between the DeviceNet network and AC motor drive.
	DVPDT01-S	Used for the connection between the DeviceNet network and S series PLC.
	DVPDT02-H2	Used for the connection between the DeviceNet network and DVP-EH2 series PLC.
	TAPCP01	The CAN bus topology tapping box with the 120ohm resistor enclosed which is effective or not via its switch.
	TAP-CN01	The CAN bus topology tapping box with the 120ohm resistor enclosed which is effective or not via its switch.
	TAP-CN02	The CAN bus topology tapping box with the 120ohm resistor enclosed which is effective or not via its switch.

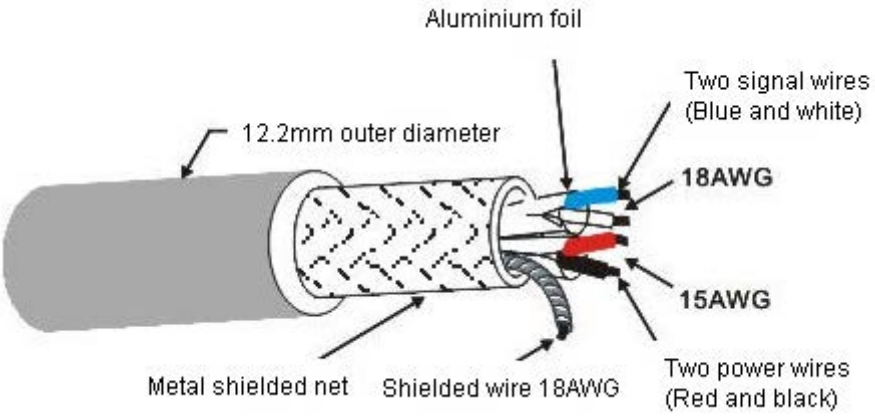
Product picture	Type	Function
	TAP-CB01	TAP-CB01: DeviceNet trunk cable
	TAP-CB02	TAP-CB02: DeviceNet drop cable

7.3.4 Choice and Purpose of DeviceNet Terminal Resistor

- **Choice of DeviceNet Terminal Resistor**
  DeviceNet network requires to install one terminal resistor of 121ohm to either end of the trunk cable.
  The thick cable represents the main cable and the thin cable represents the sub-cable.



- **Purpose of DeviceNet Terminal Resistor**
  The terminal resistor is used for eliminating the signal reflection in the communication cable.
  All signal transmission cables have the characteristic impedance. The characteristic impedance of Delta DeviceNet communication cable is about 121ohm.
  When being transmitted to the end of the communication cable, because the impedance of the end is different from the characteristic impedance, the signal will be reflected, which will interfere with the new signal and the signal wave form distortion will happen.
  The phenomenon of the signal wave form distortion is not obvious in the short-distance transmission. But the wave form distortion will become severe with the increasing communication cable. Therefore, the two ends of the trunk cable must be installed with the terminal resistors respectively.
- **Installation Position of Terminal Resistor**
  The DeviceNet communication cable consists of five wires such as red wire, blue wire, white wire, black wire and shielded wire as below.



The terminal resistors must be installed to the two ends of the trunk cable only. Since the blue wire and white wire are for signal transmission, the terminal resistor must be installed between blue wire and white wire.

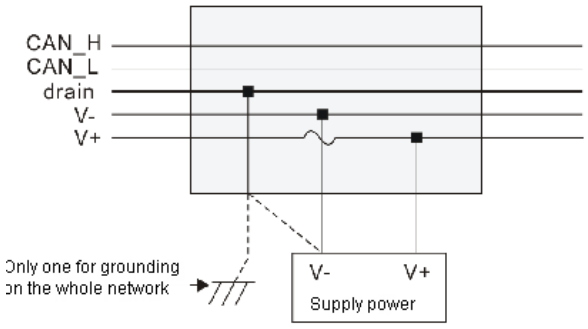
7.3.5 DeviceNet Network Supply Power

The network just needs one or multiple supply powers which supply the power to each network equipment via the bus cable.

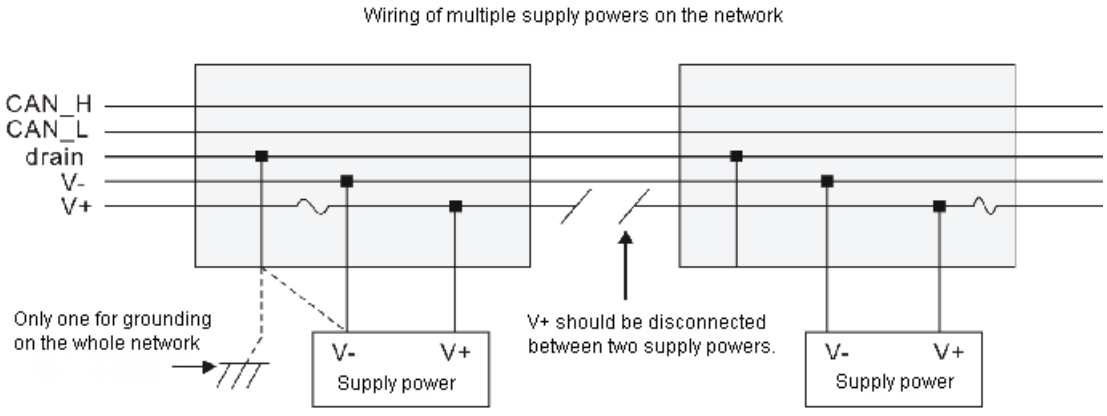
Delta DeviceNet bus cable consists of five wires, among which the power wire and signal wire occupy two wires respectively and the left one is the shielded wire as the above figure shows.

The supply power for the bus is optional and could be a single supply power or multiple supply powers according to the actual demand.

- **Single Supply Power**



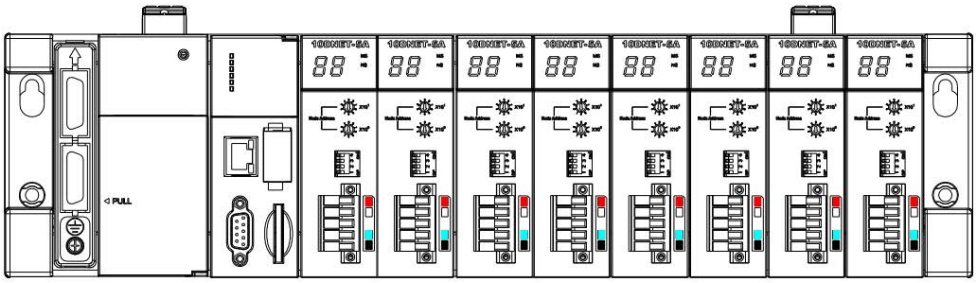
- **Multiple Supply Powers**



7.4 Configuration of AH10DNET-5A

7.4.1 Data Mapping Areas

This section is going to introduce the mapping relations between an AH500 series CPU module and AH10DNET-5A.



An AH500 series CPU module can be extended by connecting maximum 8 AH10DNET-5A scanner modules which could only be installed to the main backplane. After AH10DNET-5A and an AH500 series CPU module is connected, users could specify the starting register addresses for the input mapping and output mapping.

When only one backplane exists and there are several AH10DNET-5As on the right side of an AH500 series CPU module, the software distinguishes different AH10DNET-5As according to their unit numbers.

The farther the scanner module is away from an AH500 CPU module, the larger its unit number is.

The unit number of the first AH10DNET-5A of the right side of an AH500 series CPU module is 1. The next one nearest to the first scanner module is 2. And the following ones will be 3, 4 and so on.

7.4.2 Assignment of Mapping Area (in Master Mode)

While AH10DNET-5A works in master mode and the starting addresses for output and input are specified as D500 and D1000 respectively, the mapping area will be assigned as the following table is.

Input area: Slave-> Master			Output area: Master -> Slave		
AH500 series CPU module Register No.	**Purpose**	**Data Length**	**AH500 series CPU module Register No.**	**Purpose**	**Data Length**
D1000~D1003	Scan list node status display area (See section 7.6.1.)	4 words	D500~D503	Bit-strobe command area (See section 7.5.1.)	4 words
D1004	Scanner module status display area (See section 7.6.2.)	1 word	D504	Reserved	1 word
D1005~D1494	DeviceNet input data area: these registers are used for receiving the status data feedback from the slave.	Max. length: 490 words	D505~D994	DeviceNet output data area: the values in these registers are sent to the slave as the control data.	Max. length: 490 words

Note: D1000 and D500 in the above table are the starting addresses in the mapping area. If the addresses are set to other registers, the corresponding function will be assigned to other registers.

If the length of DeviceNet input data area is 3 words, AH10DNET-5A will occupy D1000~D1004 and D1005~D1007 in an AH500 series CPU module automatically. Meanwhile, if the length of DeviceNet output data area is 2 words, AH10DNET-5A will occupy D500~D504 and D505~D506 in an AH500

series CPU module automatically.

7.4.3 Assignment of Mapping Area (in Slave Mode)

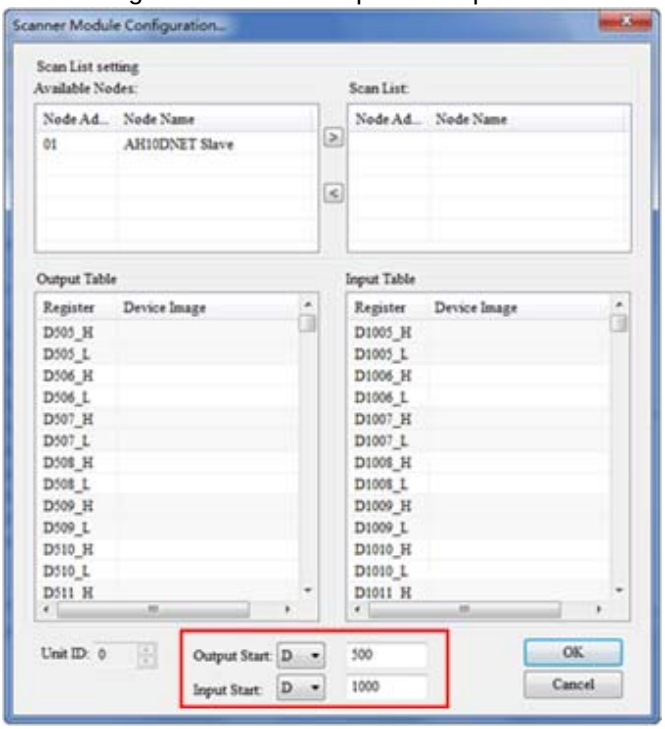
While AH10DNET-5A works in slave mode and the starting addresses for output and input are specified as D1000 and D500 respectively, the mapping area will be assigned as the following table is.

Output area: Master -> Slave			Input area: Slave-> Master		
Initial register	**Purpose**	**Max. length**	**Initial register**	**Purpose**	**Max. length**
D1000	The register is used for receiving the control data that the master sends out.	490 words	D500	The values in the register will be feedback to the master.	490 words

The data length of AH10DNET-5A can be set freely when it works as a slave.

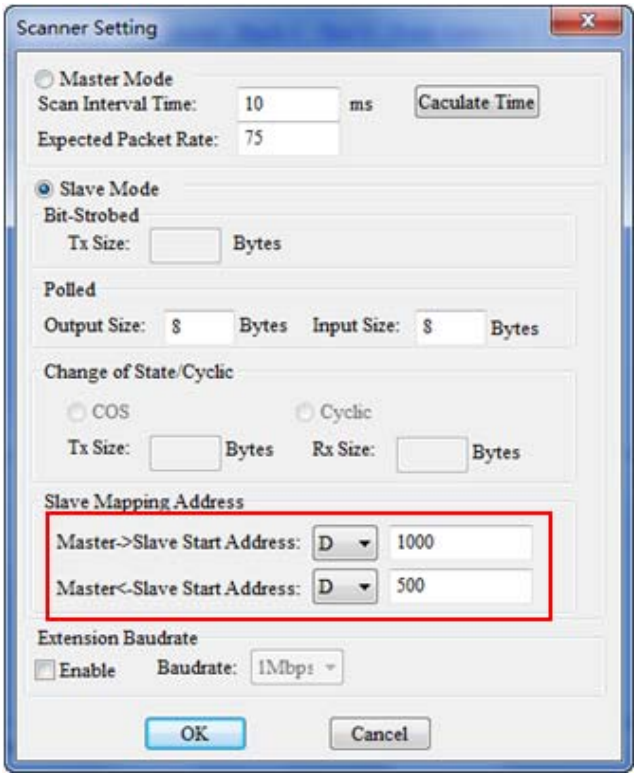
7.4.4 Data Flow Direction of Master and Slave

There are two AH10DNET-5As on the network working as the master and slave respectively. One AH10DNET-5A works as the master and the starting address of its mapping area is shown as the following window. The starting addresses for output and input are D500 and D1000 respectively.



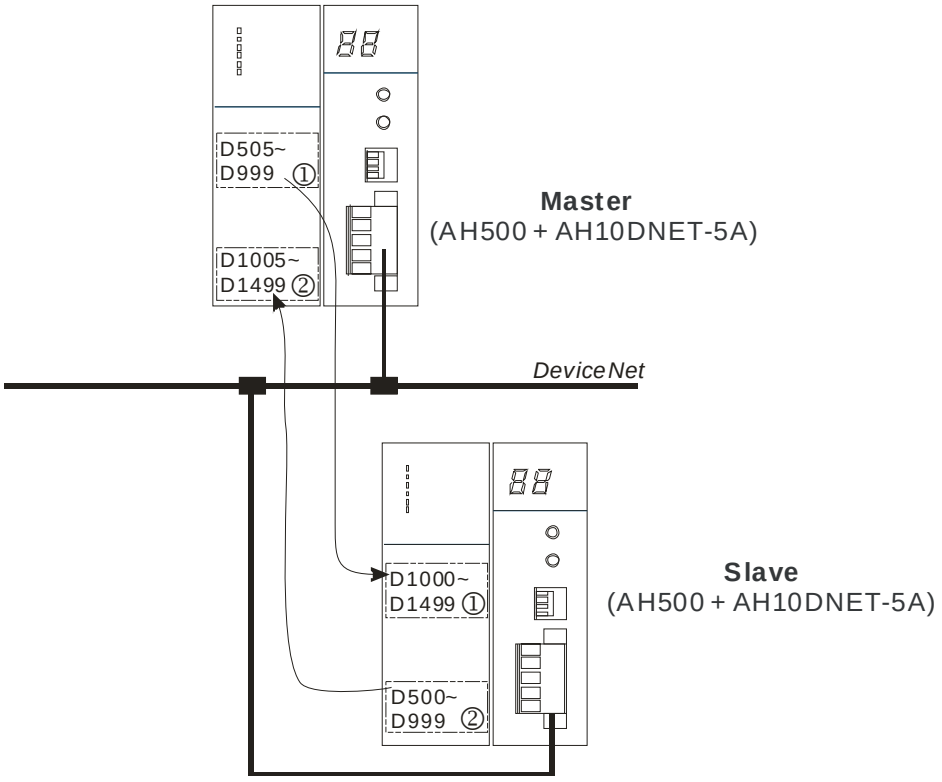
Note: D500 and D1000 in the above window are the registers in an AH500 series CPU module on the left of AH10DNET-5A functioning as a master.

The other AH10DNET-5A serves as a slave and the starting address of its mapping area is shown as below window. The data that master sends to the slave will be updated in the registers starting from D1000 and meanwhile, the values in the registers starting from D500 will be sent to the master by the slave.



Note: D1000 and D500 in the above window are the registers in an AH500 series CPU module on the left of AH10DNET-5A functioning as a slave.

The following figure illustrates the corresponding relations in the mapping areas of the master and slave. The master and slave both consist of AH10DNET-5A and an AH500 series CPU module.



Note: In the above figure, the maximum data length is introduced. But the actually configured data length may be different from it.

① represents the control data that DeviceNet master sends and these data will be updated in the registers starting from D1000 in real time. Meanwhile, ② represents the values in the registers starting from D500 and these values will be transmitted back to DeviceNet master automatically. The two groups of data will be both updated in every scan period so as to achieve the real-time control.

7.5 Bit-strobe Command

7.5.1 Bit-strobe Work Principle

Bit-strobe is one of the DeviceNet standard I/O transmission methods. The command length is fixed to 8 bytes, i.e. 64 bits. (Maximum 64 stations exist on the DeviceNet network) And one bit corresponds to one node.

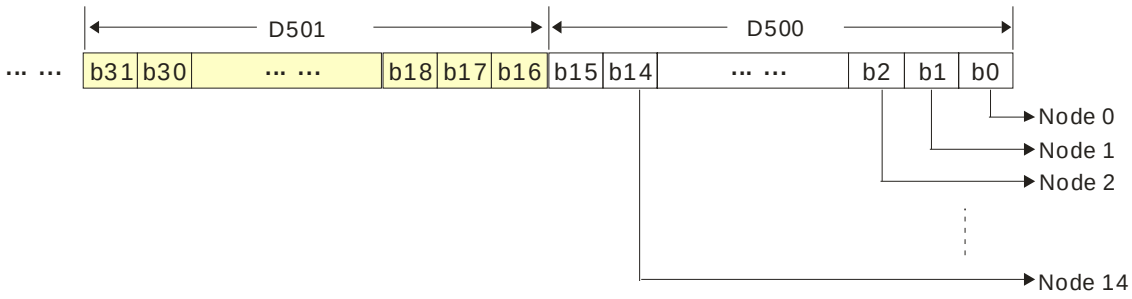
In the bit-strobe transmission method, the master does not send the control data to the slave. But when the corresponding bit is set to OFF, the slave needs to reply the I/O data to the master; when the corresponding bit is set to ON, the slave does not need to reply the I/O data to the master.

If the starting address for the output is D500, the corresponding relations between bit-strobe registers and the nodes are shown as the following table.

Bit-strobe register	Corresponding network node					
	b15	b14	b13	… …	b1	b0
D500	Node 15	Node 14	Node 13	… …	Node 1	Node 0
D501	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D502	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D503	Node 63	Node 62	Node 61	… …	Node 49	Node 48

Note:

1. If the starting address for the output is set to D123 (which you can refer to section 7.7.2), the bit-strobe registers are D123~D126 instead of D500~D503.
2. If the slave does not support the bit-strobe function, the slave will still reply the I/O message to the master after the corresponding bit is set to ON.



Suppose the starting address for the output is D500 and the slaves support the bit-strobe function. When bit 0 in D500 is OFF, the node 0 is selected and it needs to return its data to the master. When bit 0 and bit 1 are both OFF in D500, the node 0 and node 1 are both selected and they need to send their own data to the master.

7.6 Network Node Status Display

7.6.1 Scan List Node Status Display

The function is used for monitoring whether the DeviceNet slave is offline or not. The scanner module conducts the real-time monitor and control of the nodes in the scan list and maps the status of each node in the scan list to one bit so that users could acquire the status information of the network node through monitoring the value in the corresponding register.

If the starting address for the input is D1000, the corresponding relations between the node status registers and the slave are as follows.

Node status register	Corresponding network node					
	b15	b14	b13	… …	b1	b0
D1000	Node 15	Node 14	Node 13	… …	Node 1	Node 0
D1001	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D1002	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D1003	Node 63	Node 62	Node 61	… …	Node 49	Node 48

Note: If the starting address for the input is set to D567 (See section 7.7.2.), the node status registers are D567~D570 instead of D1000~D1003.

When the nodes in the scan list are normal, the corresponding bit is OFF; when the nodes are abnormal, the corresponding bit is ON.

7.6.2 Scanner Module Status Display

If the starting address for the input is D1000, users could acquire the status message of the scanner module AH10DNET-5A through monitoring D1004 in real time.

When the scanner module works normally, the content of D1004 is 0; when the scanner module is initializing, the content of the high byte and low byte in D1004 are 1 and 0 respectively; when an error occurs in the scanner module, the high byte content in D1004 is 2 and the low byte content is the error code.

Regarding the details on the error code, please refer to the seven-segment displayer in section 7.11.2.

PLC register	Description															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D1004	Scanner module status (0: Normal, 1: Initializing, 2: Error)								Error codes in the scanner module (See section 7.11.2.)							

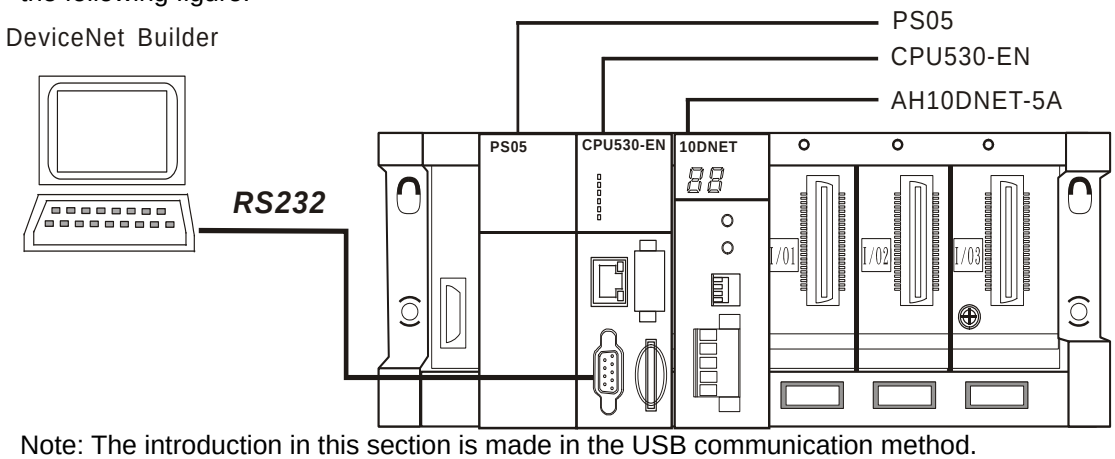
Note: If the starting address for the input is set to D600 (Refer to section 6.7.2.), the register in the above table is D604 instead of D1004.

7.7 Special Operation in Master Mode

7.7.1 Master Mode Setting

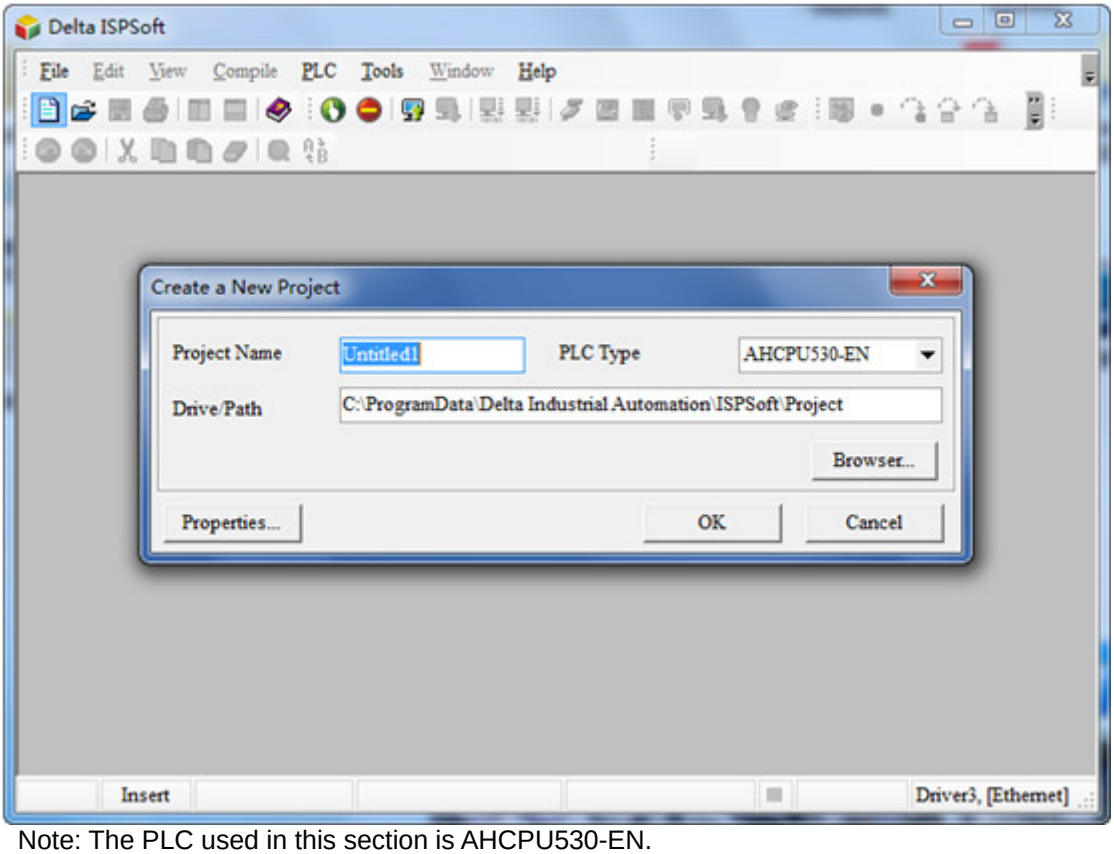
If AH10DNET-5A is in slave mode, it can be set to the master mode via the DeviceNet Builder software.

1. PC accesses an AH500 series CPU module via USB after connecting the device according to the following figure.



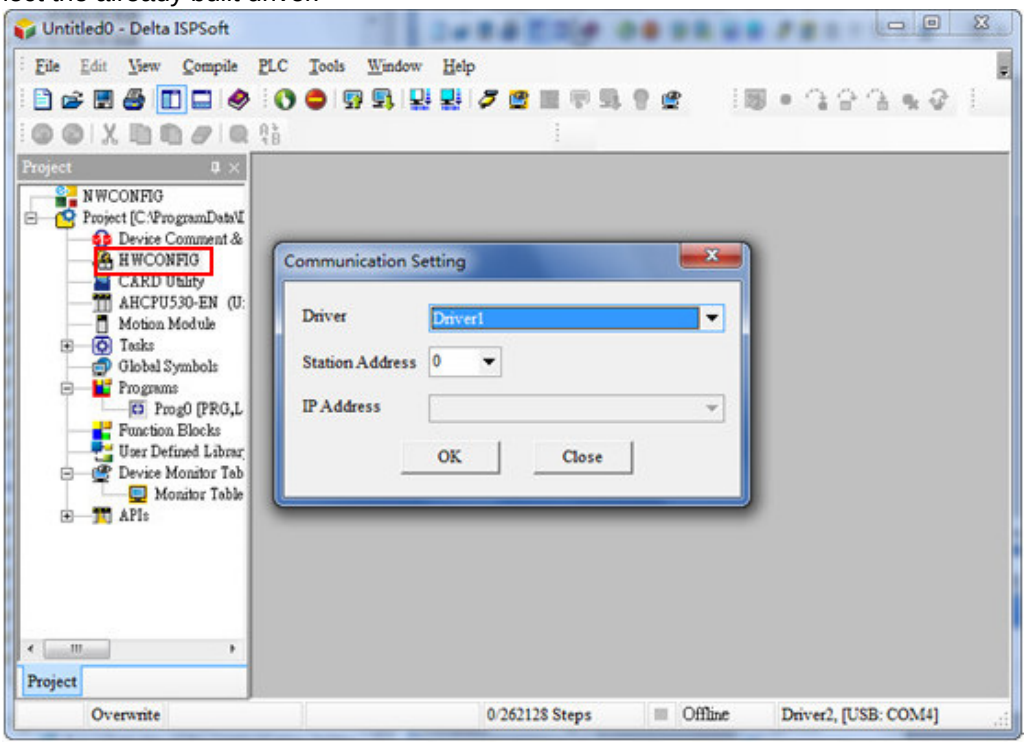
Note: The introduction in this section is made in the USB communication method.

2. Open ISPSoft, select “File” >> “New” >> “New” and then the following dialog box appears where select the corresponding PLC.



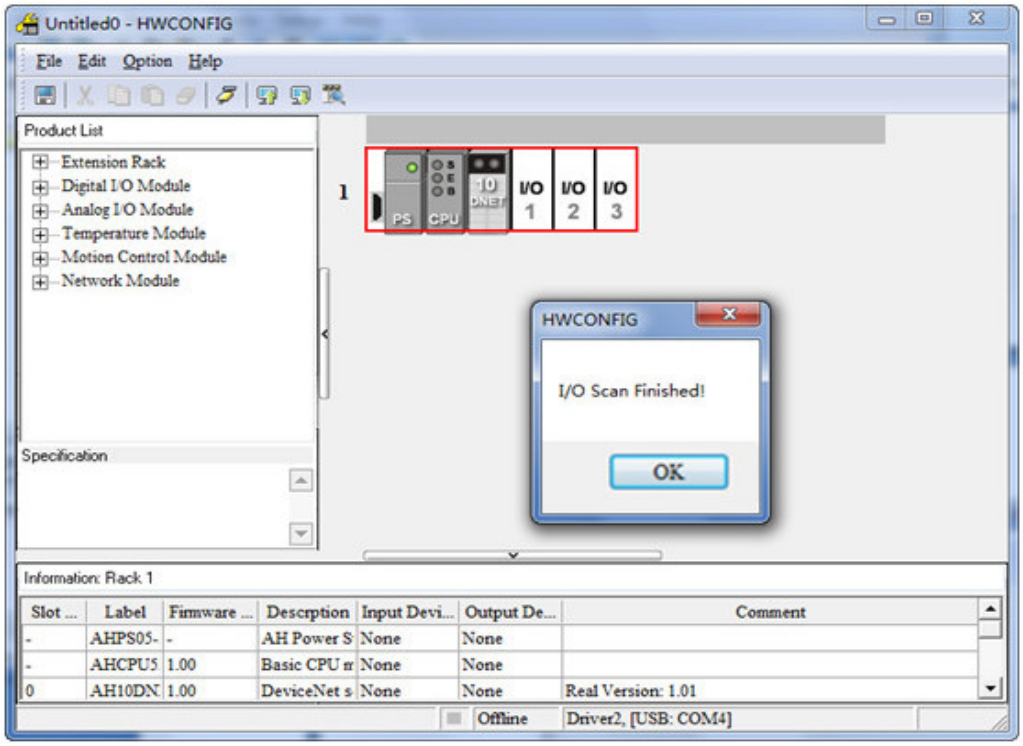
Note: The PLC used in this section is AHCPU530-EN.

3. Select “Tool” >> “Communication Setting” and then the following dialog box appears where select the already built driver.



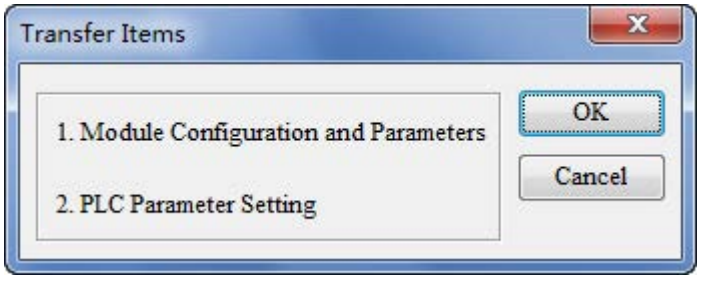
Note: The driver is built via COMMGR software. See section 8.1.4 in the help file of the DeviceNet Builder software for more.

4. Double click “HWCONFIG” symbol in the above window and then a new interface pops up, where select “Option” >> “I/O Scan” and then the icon of AH10DNET-5A will emerge as below.

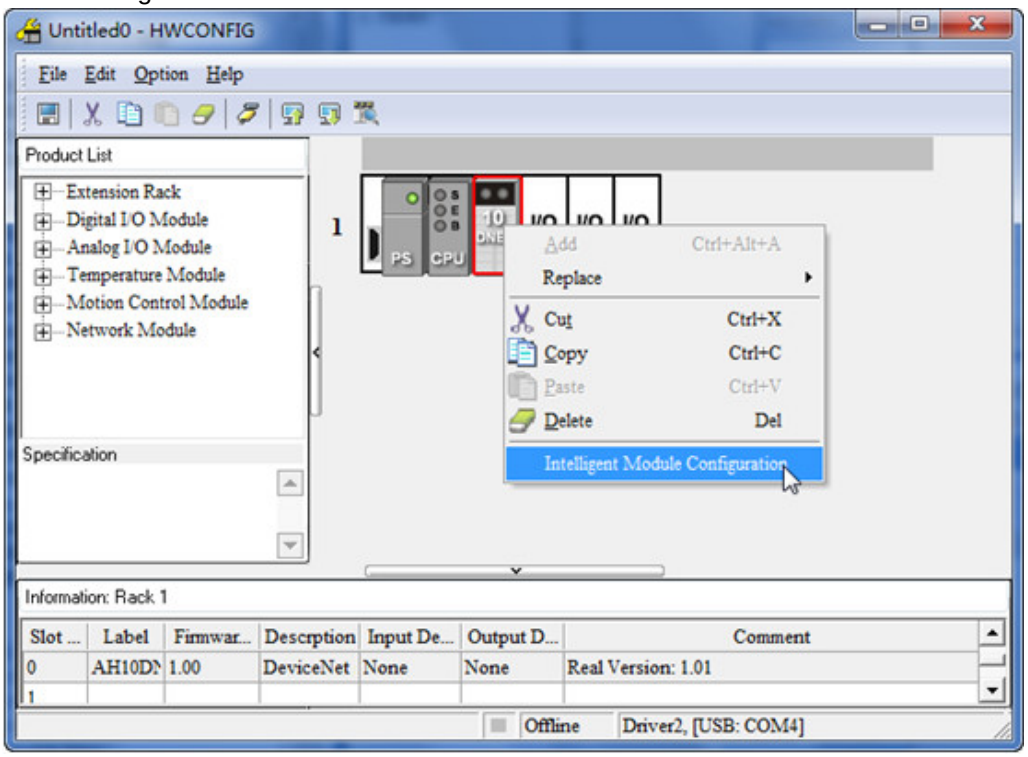


Note: AH10DNET-5A could be installed to other slot.

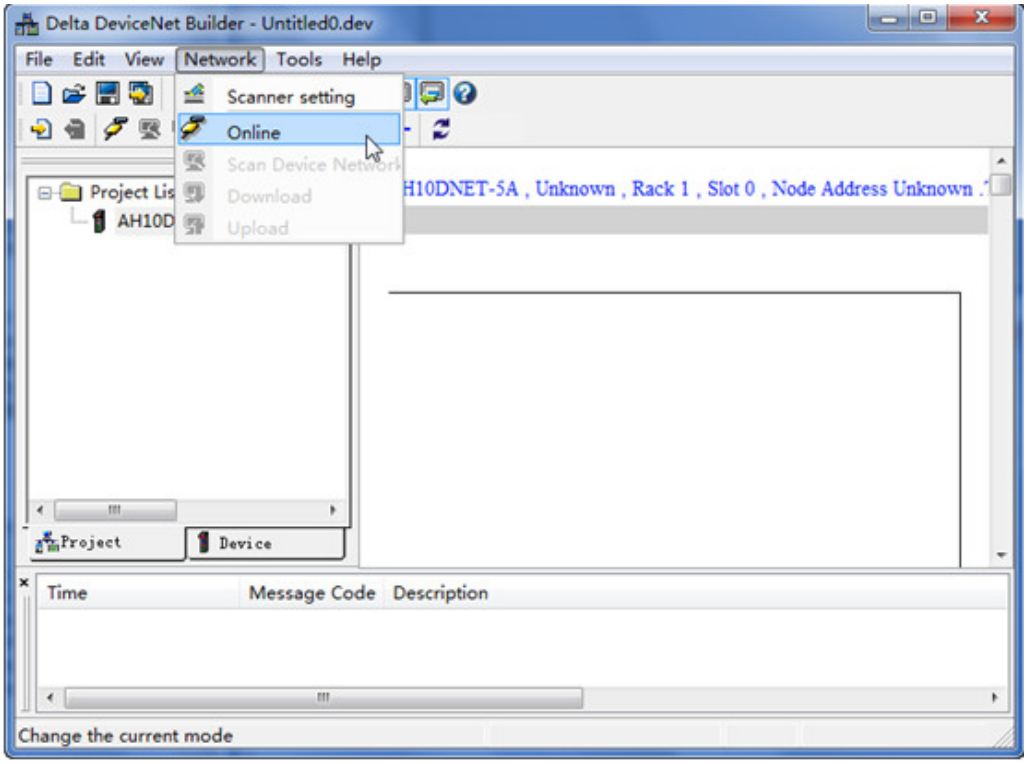
5. Select “Option” >> “Download” in the HWCONFIG software interface and then the following dialog box appears, where select “OK” to download the data.



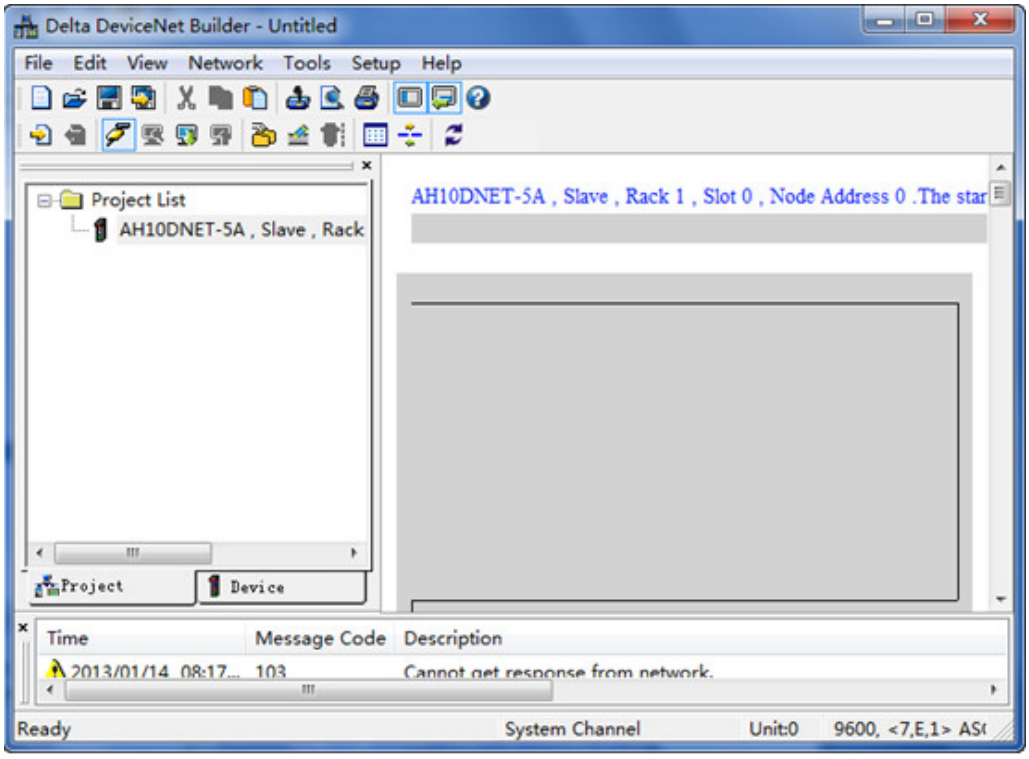
6. Right click 10DNET icon in the HWCONFIG software interface and then select “Intelligent Module Setting”.



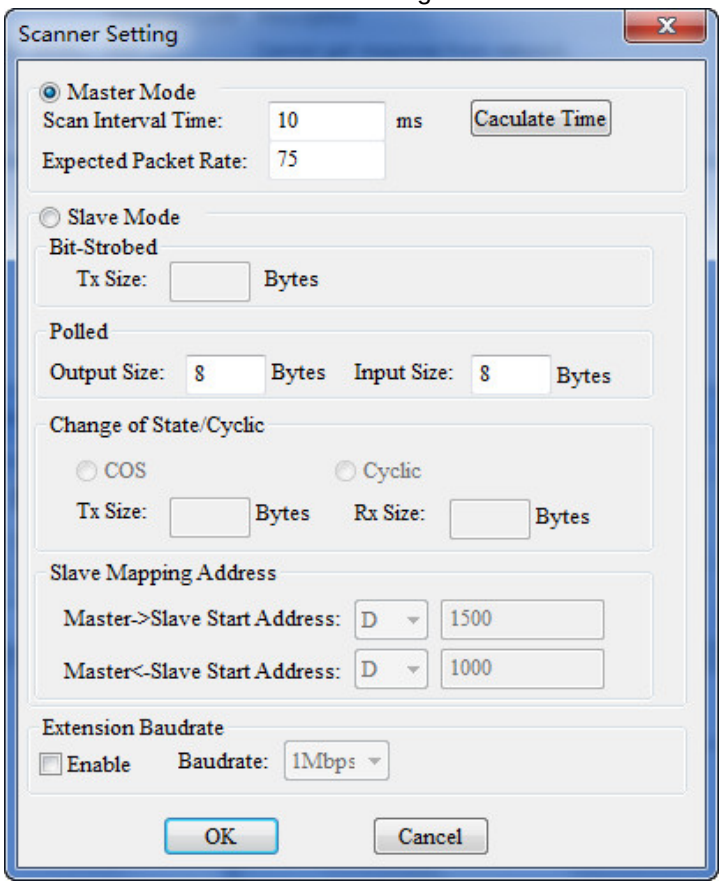
7. The DeviceNet Builder software is called out, where select “Network” >> “Online”.



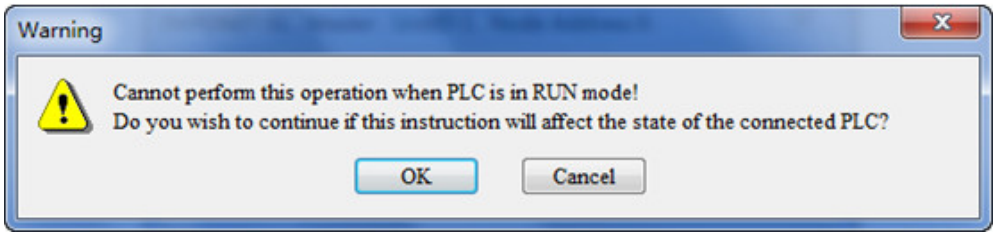
8. Select “Network” >> “Online” and the software interface will be shown as below.



9. Select “Network” >> “Scanner Setting” and then “Scanner Setting” dialog box appears, where pick “Master Mode” and then click “OK” after setting is over.



10. Select “Network” >> “Download” and then the following dialog box appears, where click “OK” to download the configuration data to AH10DNET-5A automatically.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

Note: If “E7” is displayed on AH10DNET-5A, please remove its DeviceNet terminals before downloading. Otherwise, failure to download will occur.

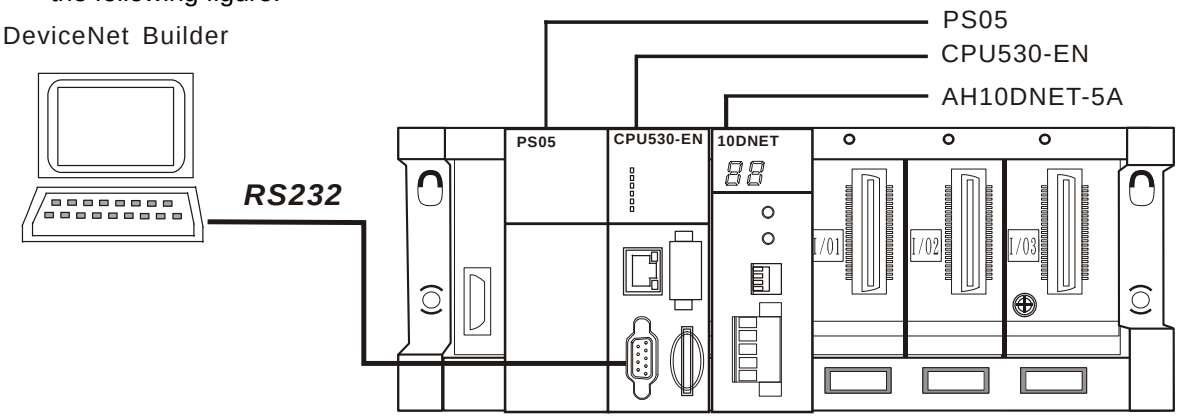
11. Power off the AH500 series CPU module and then power it on again after downloading is finished. And at the time, AH10DNET-5A is set to the master mode.

7.7.2 Mapping Areas Setting

When AH10DNET-5A serves as a master, there are two methods of modifying the starting address of its mapping areas.

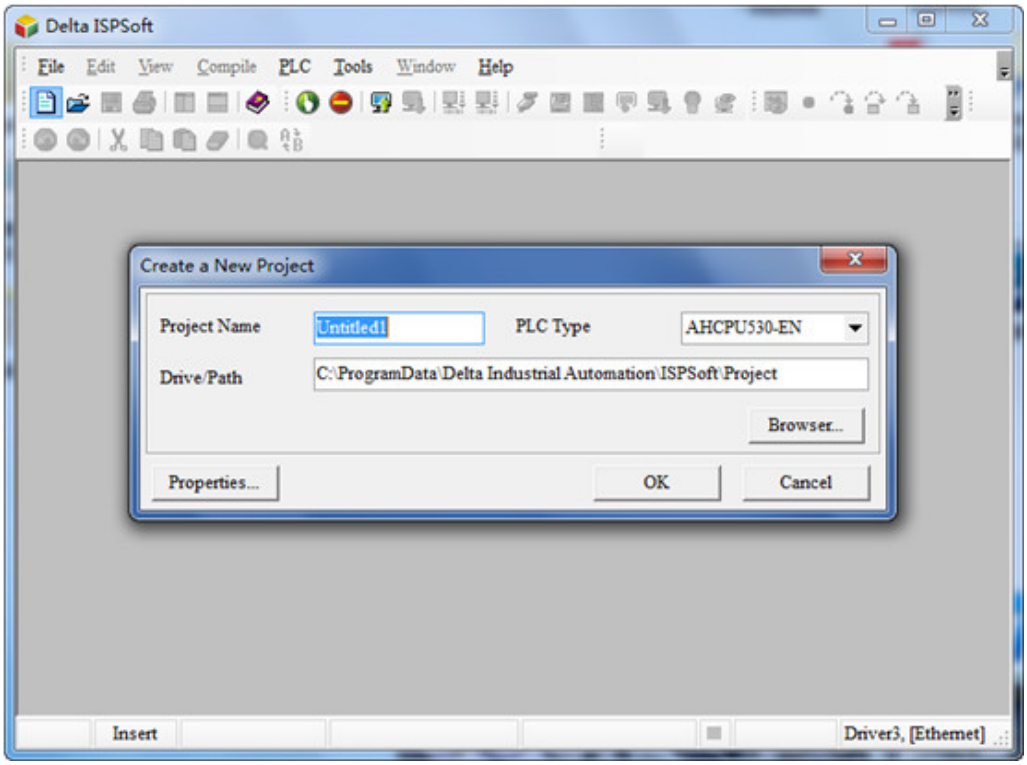
Method 1: Modify the starting address of the mapping areas through ISPSoft and DeviceNet Builder

1. PC accesses an AH500 series CPU module via USB after connecting the device according to the following figure.



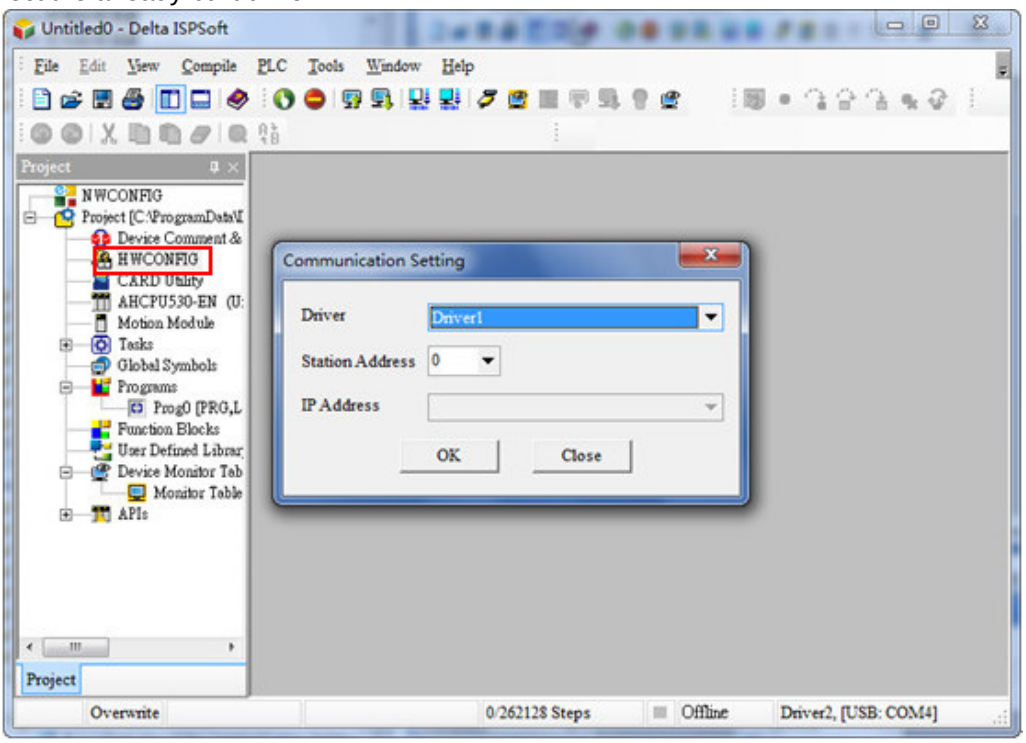
Note: The introduction in this section is made in the USB communication method.

2. Open ISPSoft, select “File” >> “New” >> “New” and then the following dialog box appears where select the corresponding PLC.



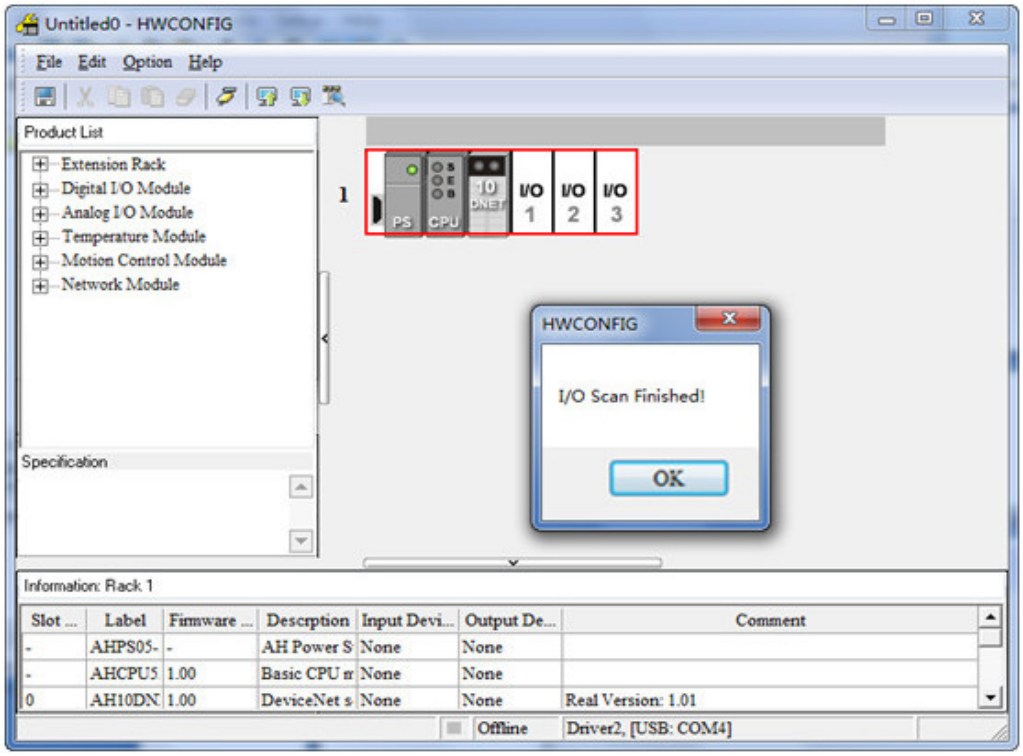
Note: The PLC used in this section is AHCPU530-EN.

3. Select “Tool” >> “Communication Setting” and then the following dialog box appears where select the already built driver.



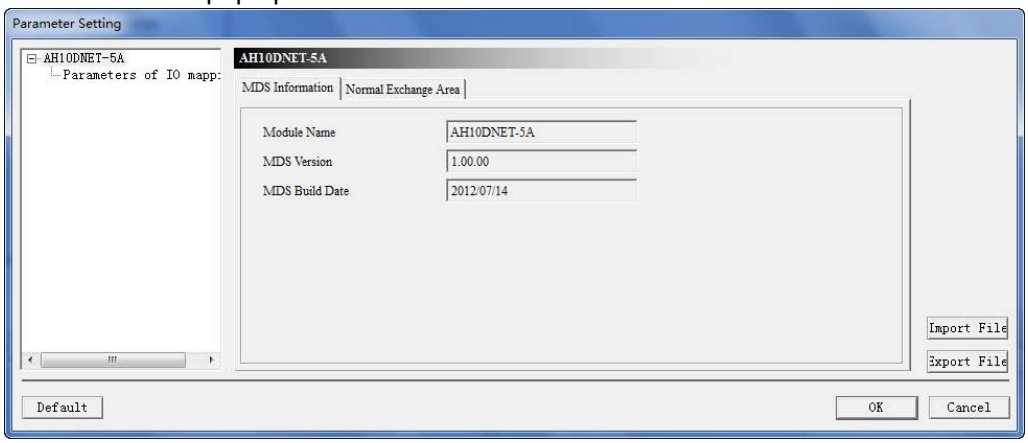
Note: The driver is built via COMMGR software. See section 8.1.4 in the help file of the DeviceNet Builder software for more.

4. Double click “HWCONFIG” symbol in the above window and then a new interface pops up, where select “Option” >> “I/O Scan” and then the icon of AH10DNET-5A will emerge as below.

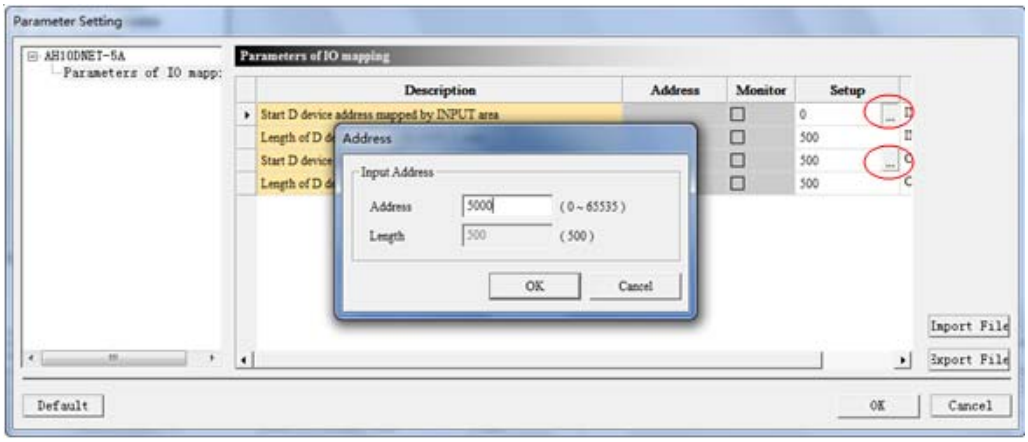


Note: AH10DNET-5A could be installed to other slot.

5. Double click 10DNET icon in the above window and the parameter configuration interface of AH10DNET-5A will pop up as follows.

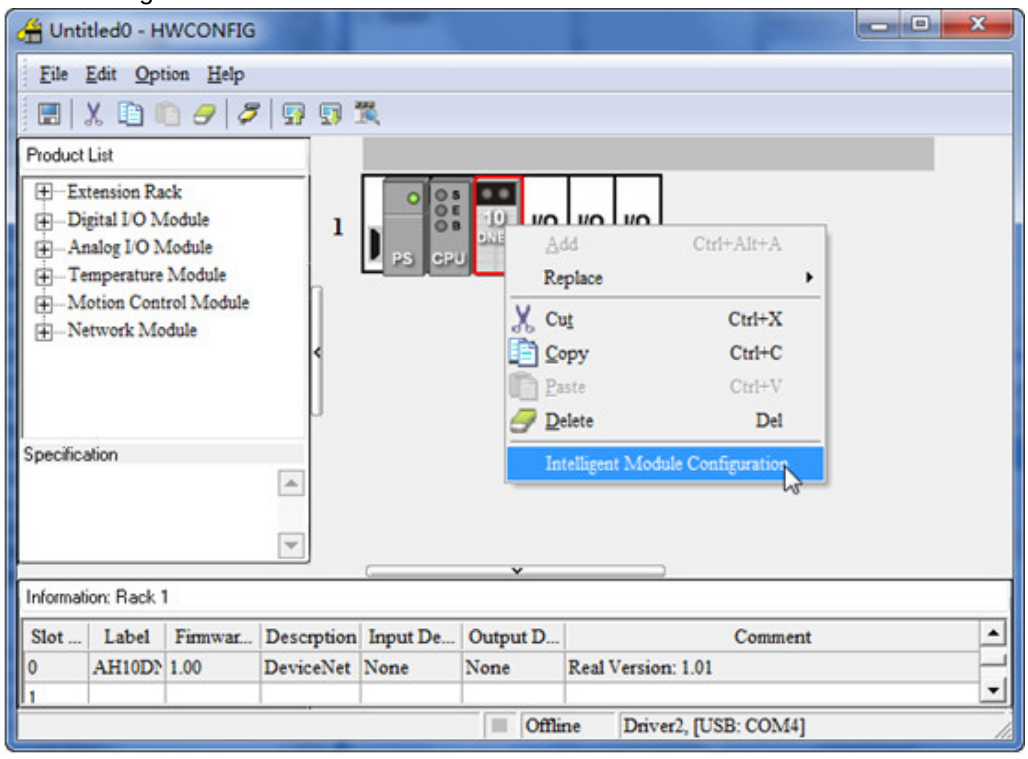


Double click “Parameter of IO Mapping” on the above window; set the value in “Parameters of IO mapping” and the set value is the starting address of the mapping area. Click “OK” after setting is over.

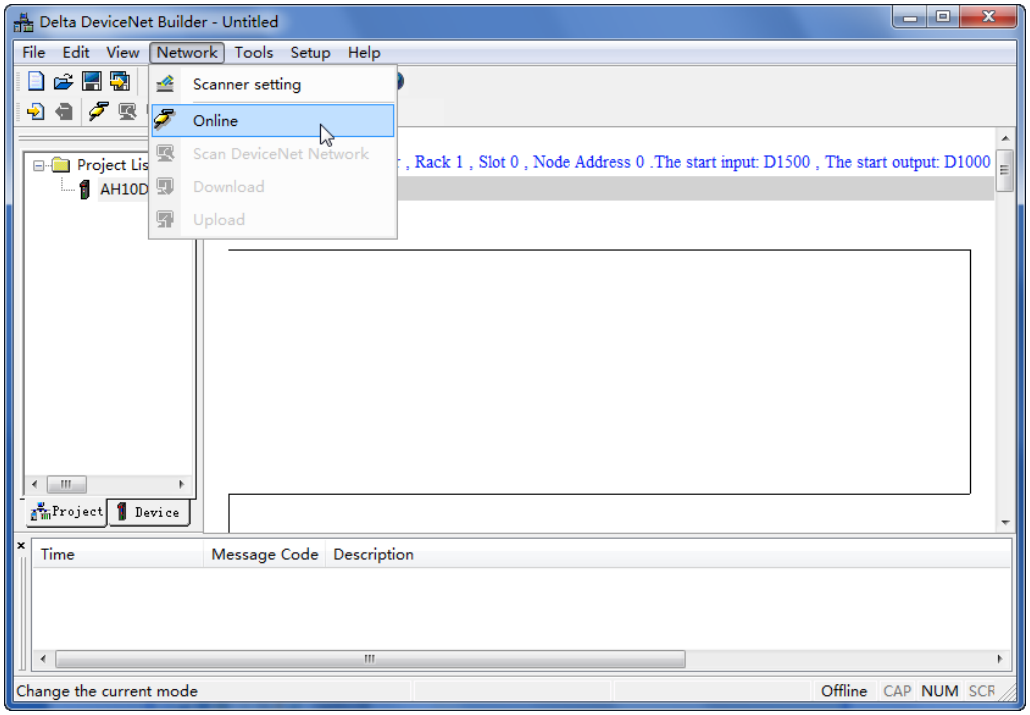


Note: The set value is the starting address of the mapping area. Both of the length of the input and output mapping areas is 500 words.

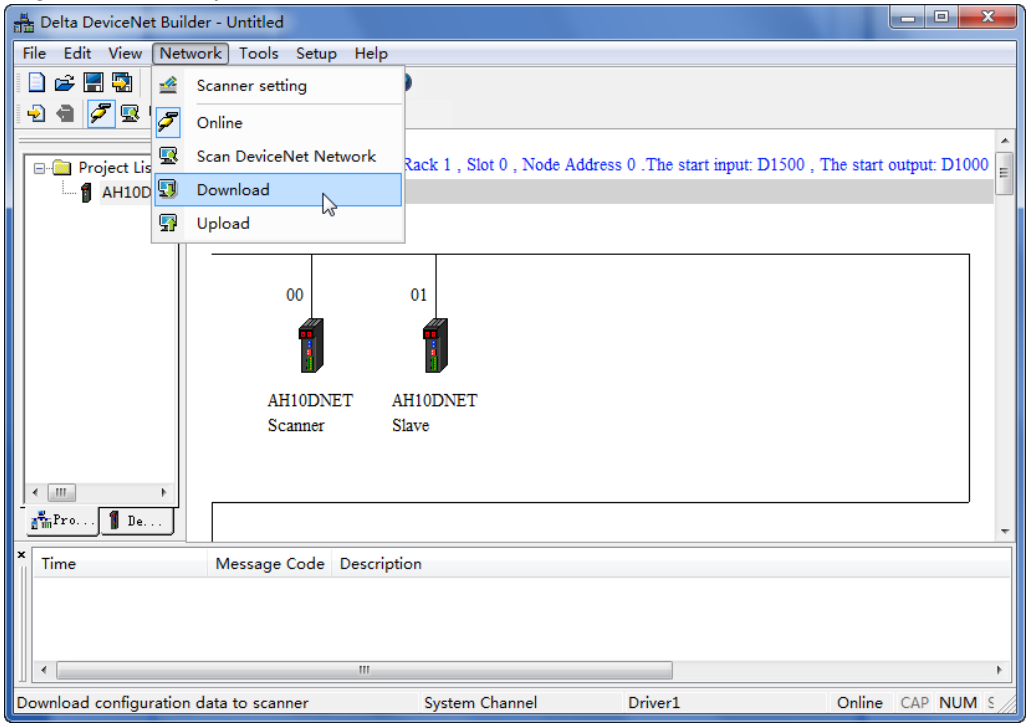
6. Right click 10DNET icon in the HWCONFIG software interface and then select “Intelligent Module Setting”.



7. The DeviceNet Builder software is called out, where select “Network” >> “Online”.



8. Select “Network” >> “Download” to download the starting address of the mapping area and the configuration data to AH10DNET-5A after the network enters the online mode and the configuration is completed.

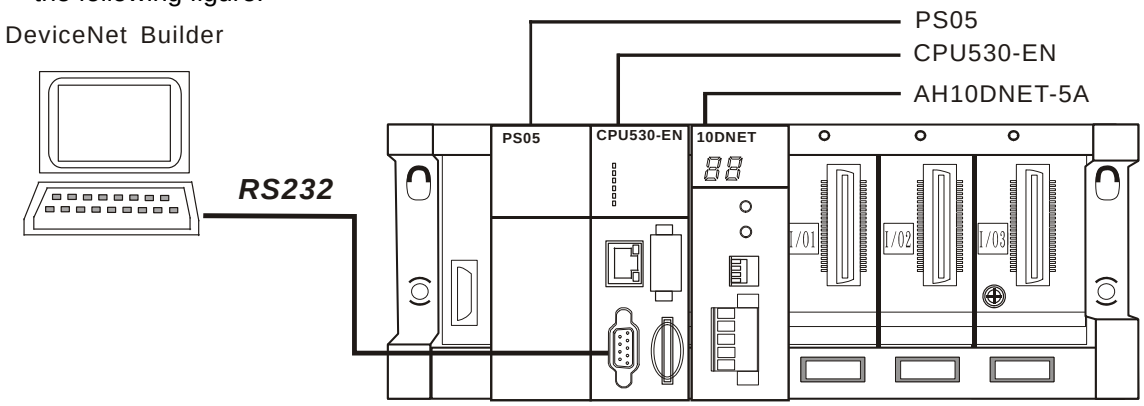


9. Power off the AH500 series CPU module and then power it on again after downloading is finished. And at the time, the starting address of the mapping area is modified successfully.

Method 2: Modify the starting address of the mapping areas through DeviceNet Builder

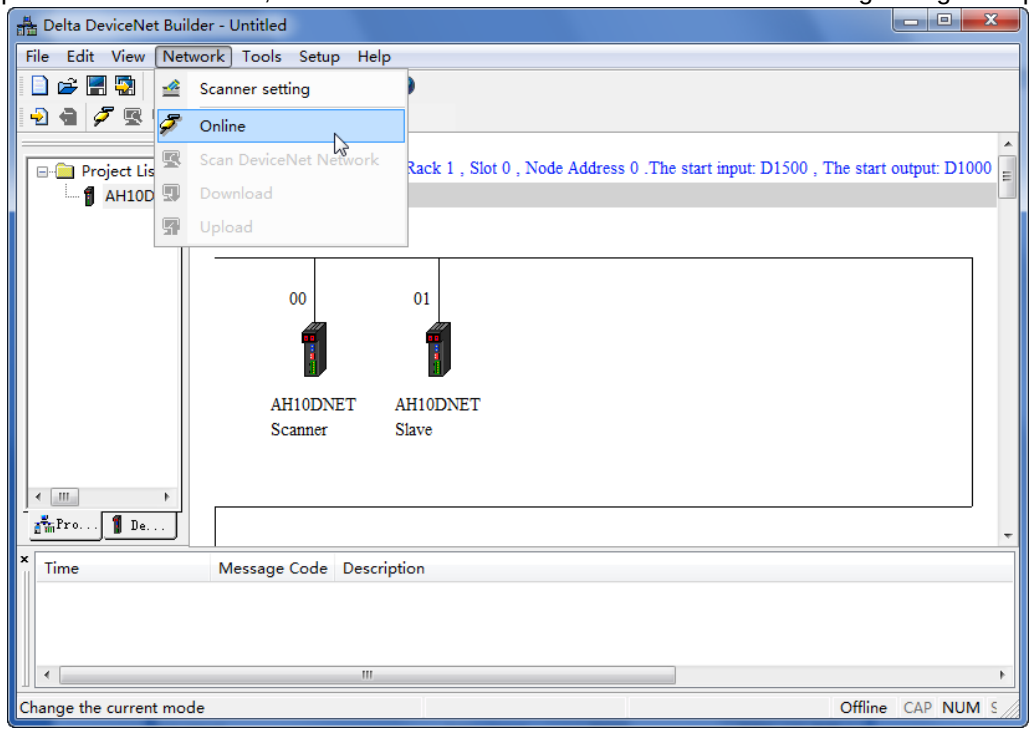
Note: Compared to the first method, the second one is a bit simpler but D device is probably used by multiple modules at the same time because of no uniform configuration through HWCONFIG. Please think carefully before adopting this method.

1. PC accesses an AH500 series CPU module via USB after connecting the device according to the following figure.

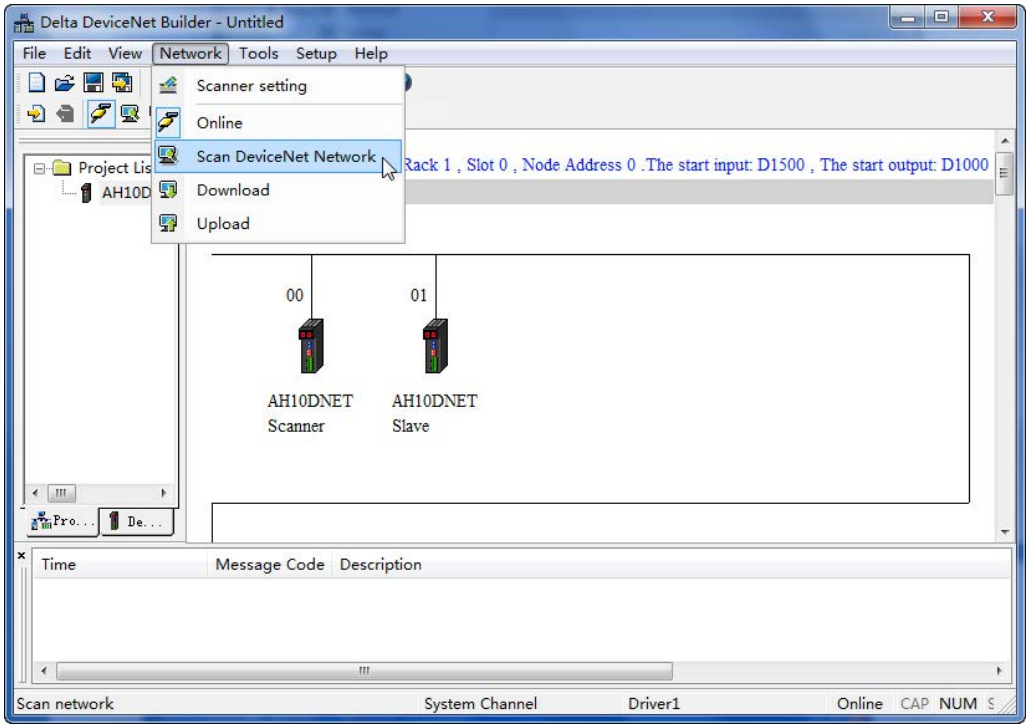


Note: The introduction in this section is made in the USB communication method.

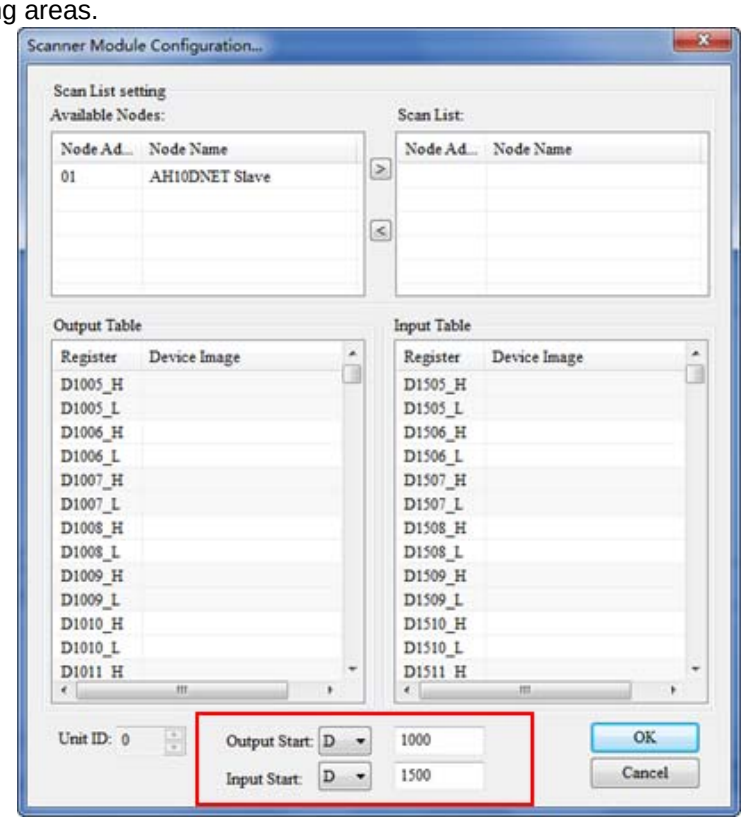
2. Open DeviceNet Builder, select “Network” >> “Online” and then the following dialog box appears



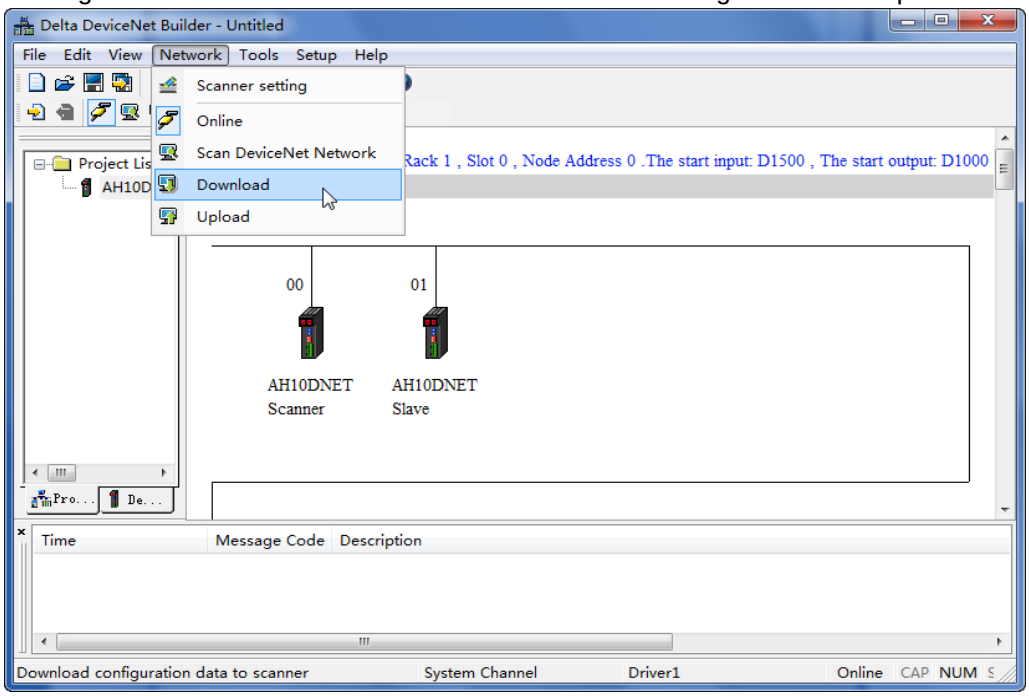
3. Select “Network” >> “Scan DeviceNet Network” and the whole network will be scanned.



4. Double click AH10DNET Scanner icon on the above software interface and then the following dialog box appears where “Output Start” and “Input Start” are for setting the starting addresses of the mapping areas.



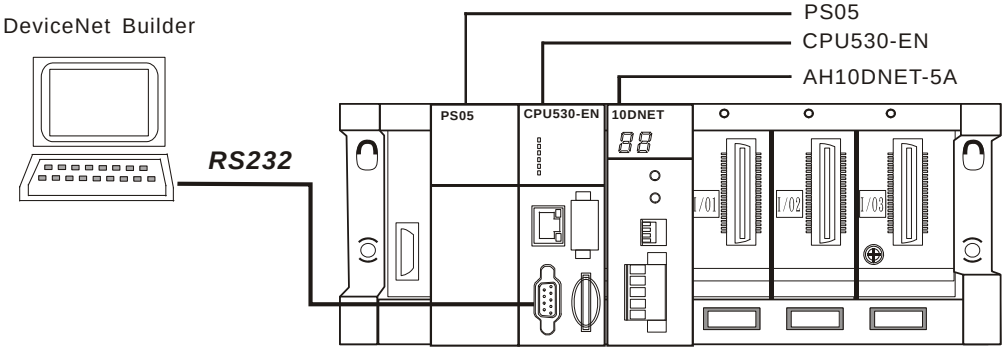
5. Select “Network” >> “Download” to download the starting addresses of the mapping areas and the configuration data to AH10DNET-5A after the network configuration is completed.



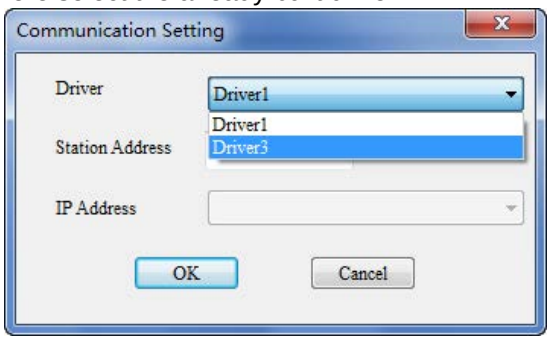
6. Power off the AH500 series CPU module and then power it on again after downloading is finished. And at the time, the starting addresses of the mapping areas are modified successfully.

7.7.3 Extension Baud Rate Setting

1. PC accesses AH 500 via RS232 after connecting the device according to the following figure.

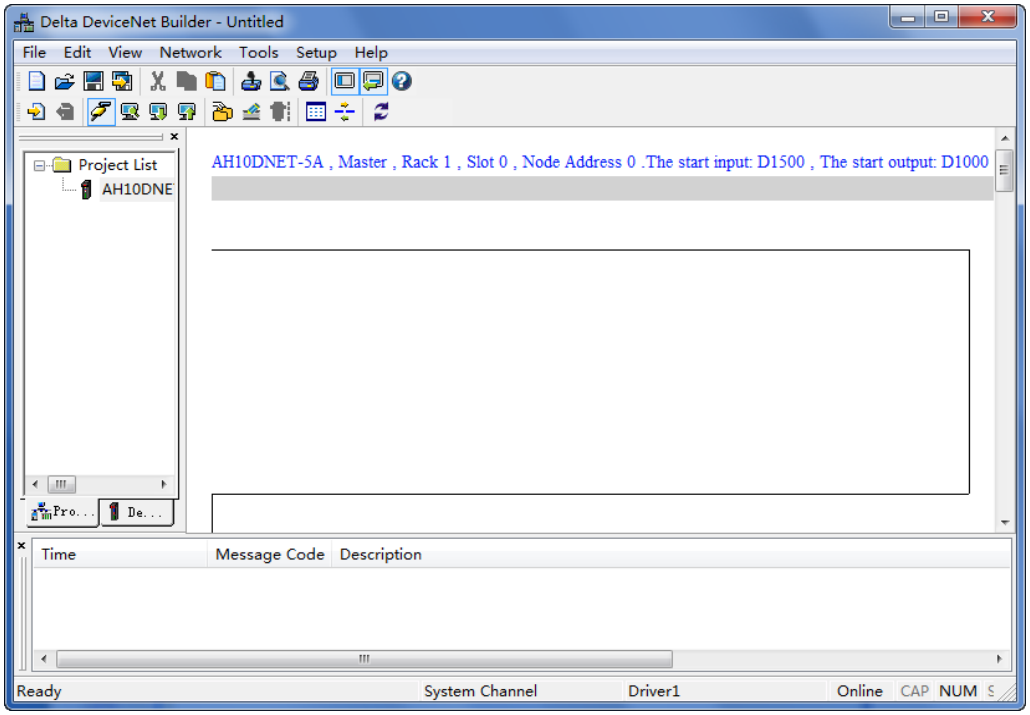


2. Open DeviceNet Builder; then select “Setup” >> “Communication Setting” and then the following dialog box appears, where select the already built driver.

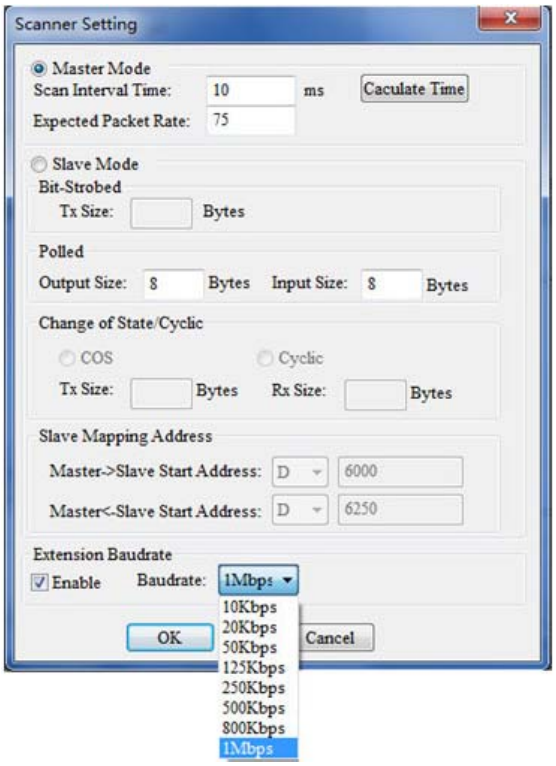


Note: The driver is built through COMMGR. Please refer to section 8.1.3 in DeviceNet Builder help file.

3. Select “Network” >> “Online” as below.

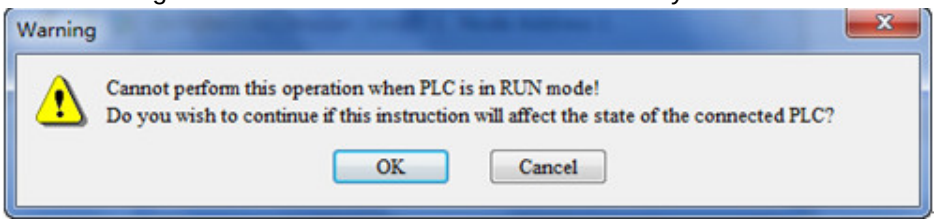


4. Select “Network” >> “Scanner Setting” and then the “Scanner Setting” dialog box pops up. By picking “Master Mode” and “Enable”, the extension baud rate function is started up. Afterwards, select an appropriate baud rate according to the actual demand. Click “OK” after selection is over.



Note: If “Slave Mode” is selected, AH10DNET-5A will be set to a slave eventually.

5. Select “Network” >> “Download” and then the following dialog box appears, where click “OK” to download the configuration data to AH10DNET-5A automatically.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

Note: If “E7” is displayed on AH10DNET-5A, please remove its DeviceNet terminals before downloading. Otherwise, failure to download will occur.

6. After downloading is completed, turn both of the function switch DR0 and DR1 of AH10DNET-5A to ON and then re-power the AH500 series CPU module. At the time, the extension baud rate setting is finished.

7.8 Special Operation in Slave Mode

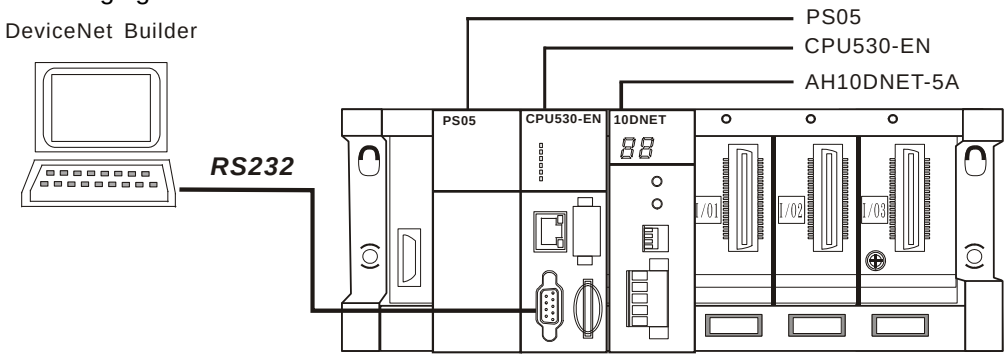
7.8.1 Slave Mode and Mapping Areas Setting

AH10DNET-5A can be set to the DeviceNet slave through the software. When AH10DNET-5A works as a slave, the default input/ output length is 8 bytes and maximum input/output data length is 1000 bytes.

There are two methods of setting AH10DNET-5A to the slave. While the slave mode is being set, the starting addresses of the mapping areas of AH10DNET-5A can be set simultaneously.

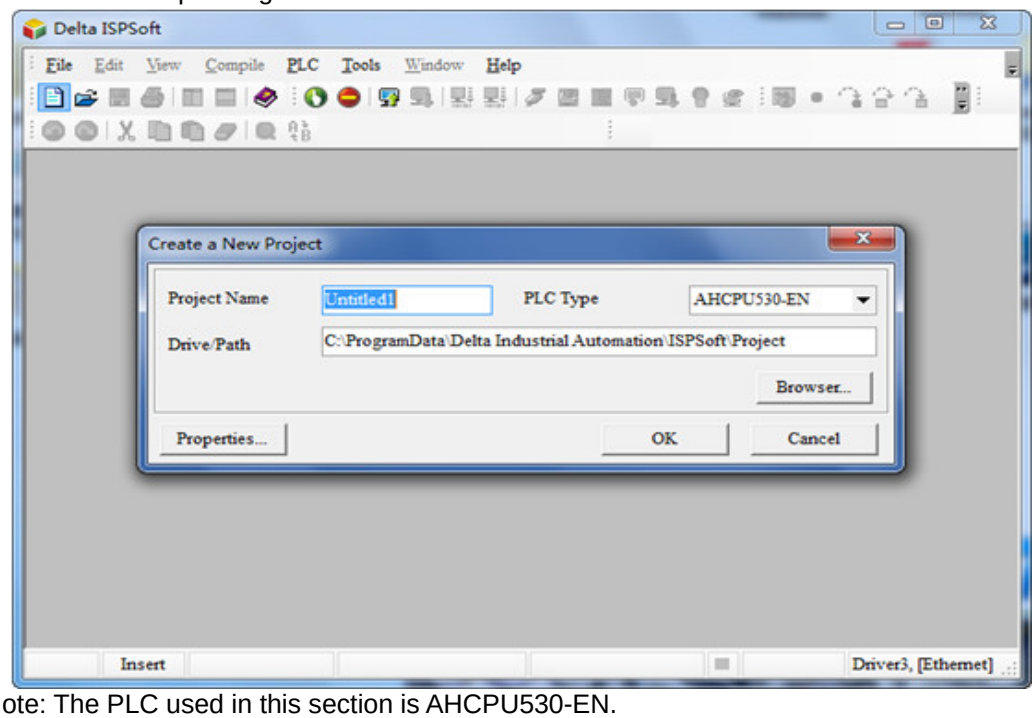
Method 1: Set slave mode and the starting addresses of the mapping areas through ISPSoft and DeviceNet Builder

1. PC accesses an AH500 series CPU module via USB after connecting the device according to the following figure.



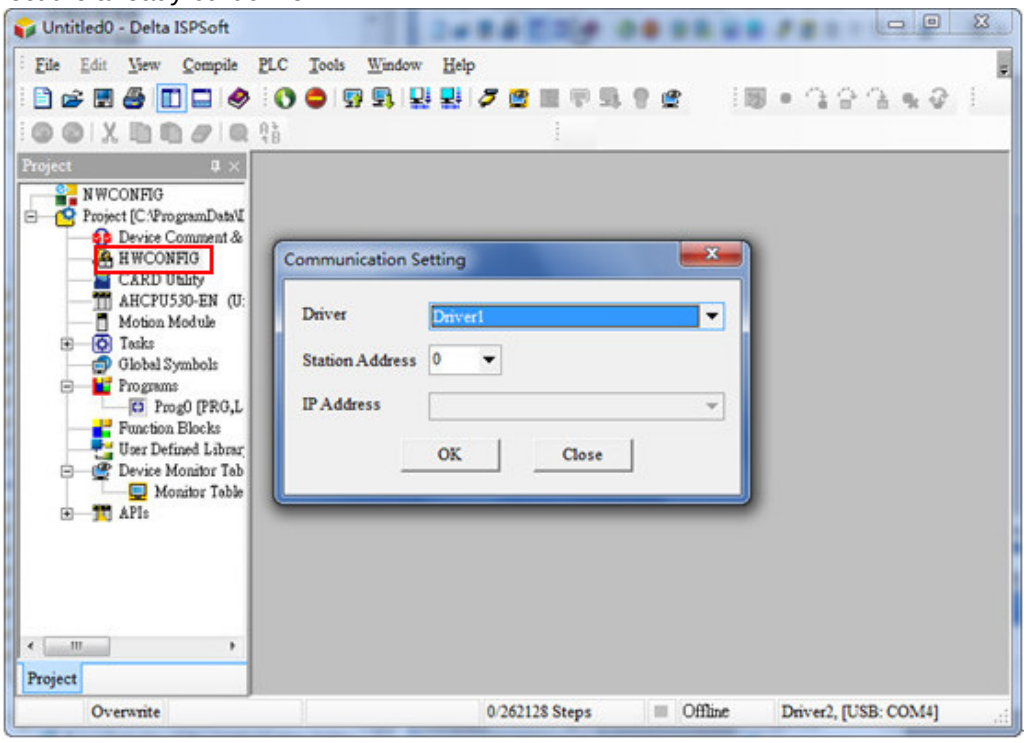
Note: The introduction in this section is made in the USB communication method.

2. Open ISPSoft, select “File” >> “New” >> “New” and then the following dialog box appears where select the corresponding PLC.



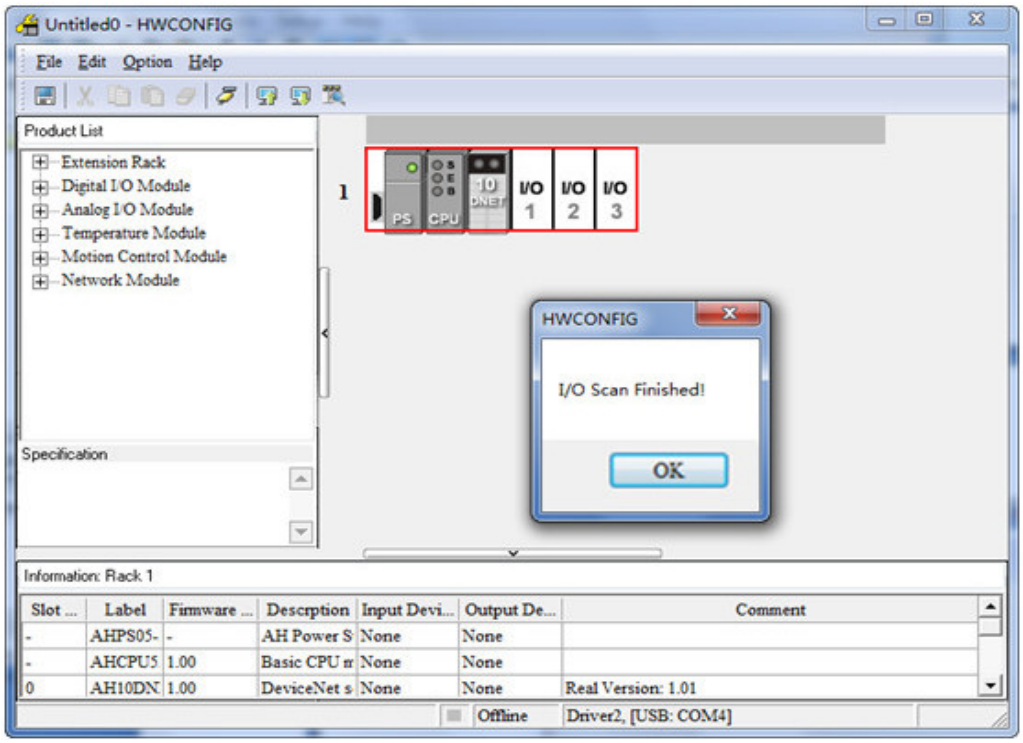
Note: The PLC used in this section is AHCPU530-EN.

3. Select “Tool” >> “Communication Setting” and then the following dialog box appears where select the already built driver.



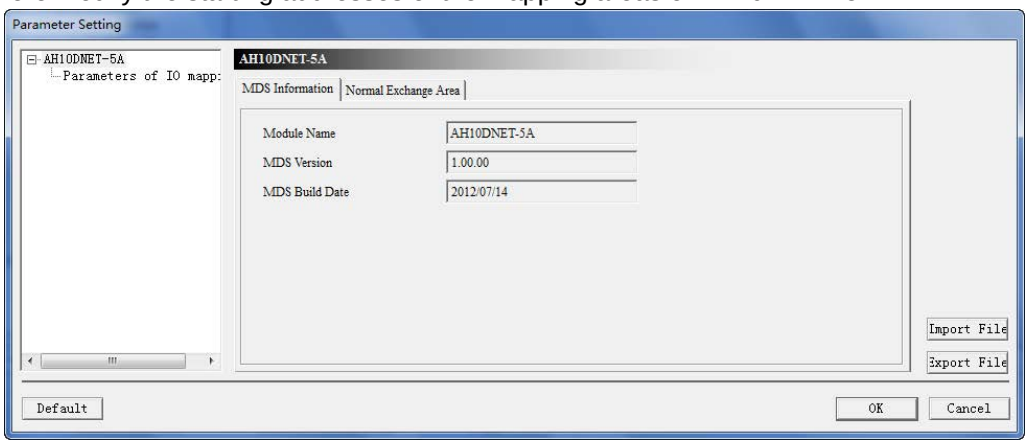
Note: The driver is built via COMMGR software. See section 8.1.4 in the help file of the DeviceNet Builder software for more.

4. Double click “HWCONFIG” symbol in the above window and then a new interface pops up, where select “Option” >> “I/O Scan” and then the icon of AH10DNET-5A will emerge as below.

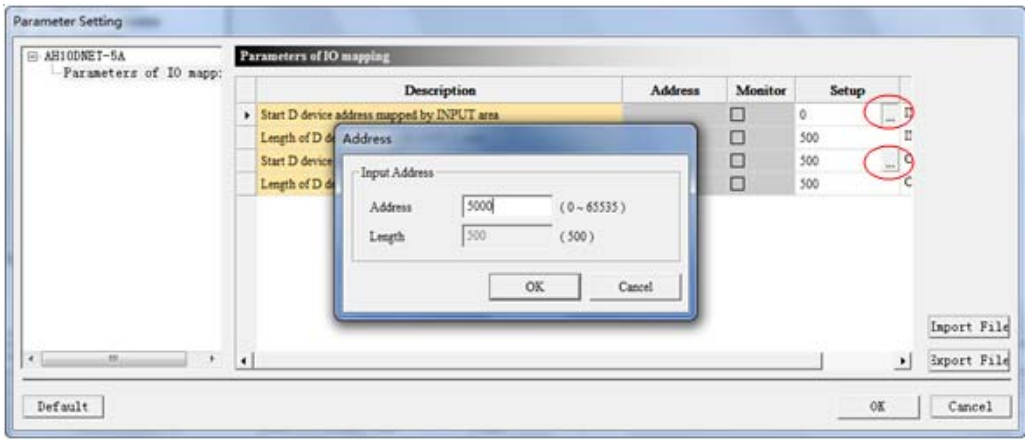


Note: AH10DNET-5A could be installed to other slot.

5. Double click 10DNET icon in the above window and then the following dialog box appears, where modify the starting addresses of the mapping areas of AH10DNET-5A.

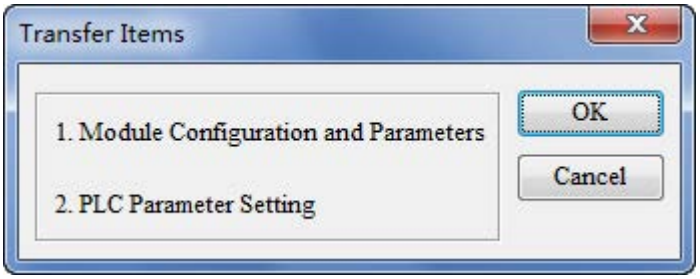


Double click “Parameter of IO Mapping” on the above window; set the value in “Parameters of IO mapping” and the set value is the starting address of the mapping area. Click “OK” after setting is over.

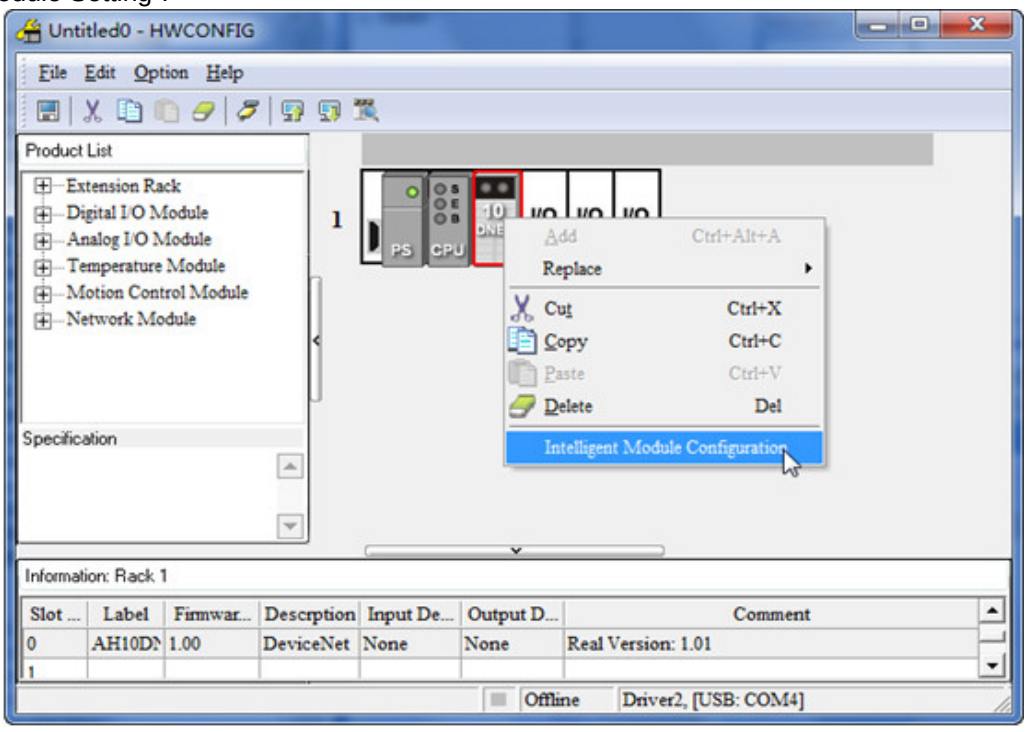


Note: The set value is the starting address of the mapping area. Both of the length of the input and output mapping areas is 500 words.

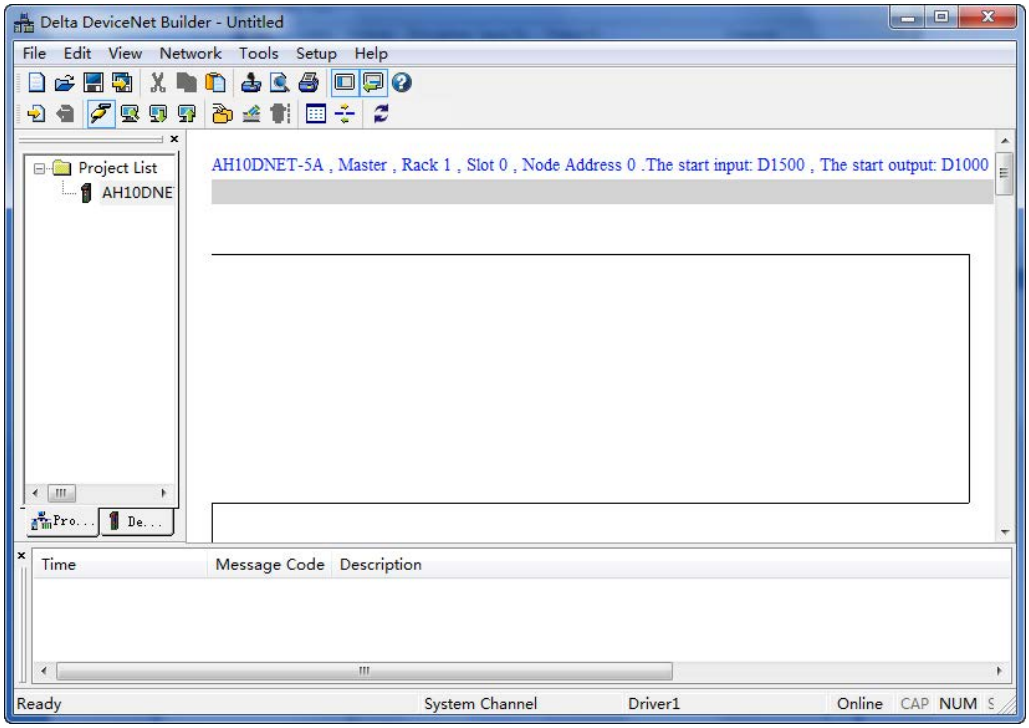
6. Select “Option” >> “Download” in the HWCONFIG interface and then the following dialog box appears, where click “OK” to download the data.



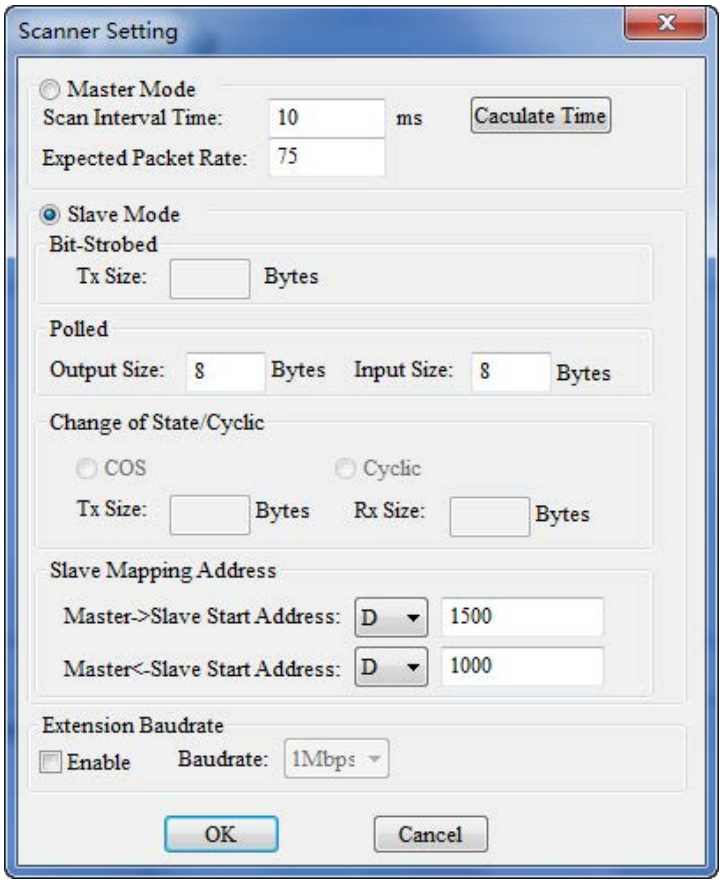
7. Right click 10DNET icon in the HWCONFIG software interface and then select “Intelligent Module Setting”.



8. Select “Network” >> “Online” and the software interface is shown as below.

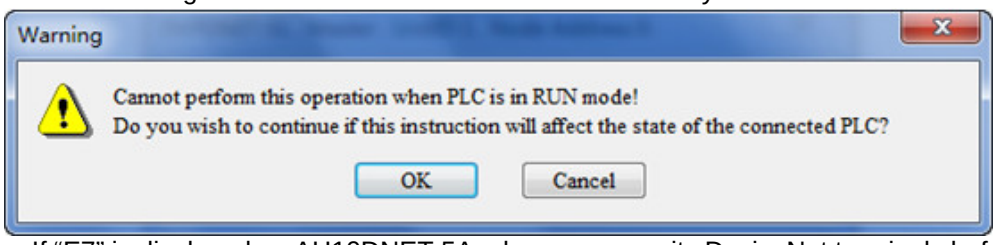


9. Select “Network” >> “Scanner Setting” and “Scanner Setting” dialog box pops up. After picking “Slave Mode”, fill the appropriate data length and mapping address of the slave. Click “OK” after setting is over.



Note: “Output Size” and “Input Size” under “Polled” in the above window are used for setting the data length of AH10DNET-5A as the slave.

10. Select “Network” >> “Download” and then the following dialog box appears, where click “OK” to download the configuration data to AH10DNET-5A automatically.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

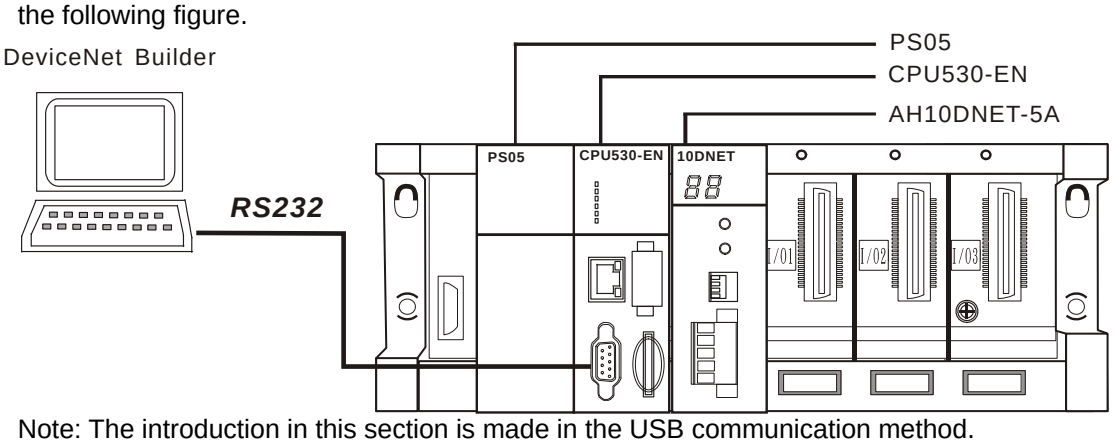
Note: If “E7” is displayed on AH10DNET-5A, please remove its DeviceNet terminals before downloading. Otherwise, failure to download will occur.

11. Power off the AH500 series CPU module and then power it on again after downloading is finished. And at the time, AH10DNET-5A is set to the slave mode.

Method 2: Set slave mode and the starting addresses of the mapping areas through DeviceNet Builder

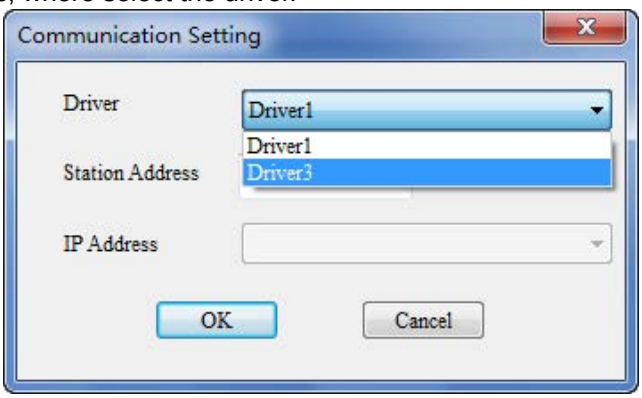
Note:Compared to the first method, the second one is a bit simpler but D device is probably used by multiple modules at the same time because of no uniform configuration through HWCONFIG. Please think carefully before adopting this method.

1. PC accesses an AH500 series CPU module via USB after connecting the device according to the following figure.



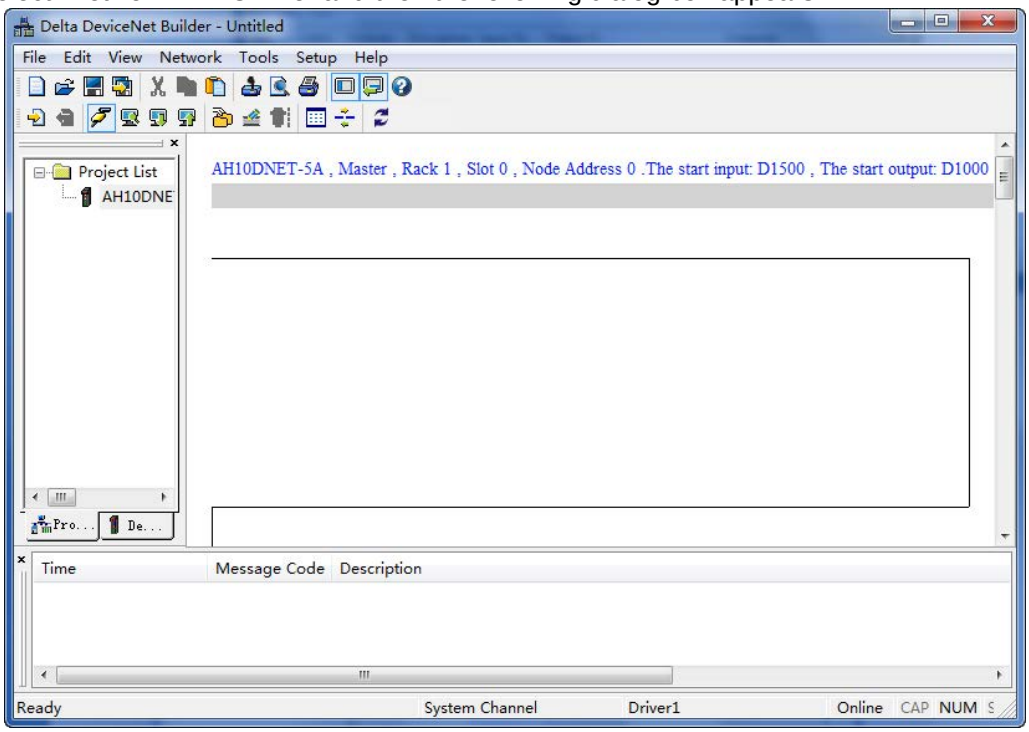
Note: The introduction in this section is made in the USB communication method.

2. Open DeviceNet Builder, select “Setup” >> “Communication Setting” and then the following dialog box appears, where select the driver.

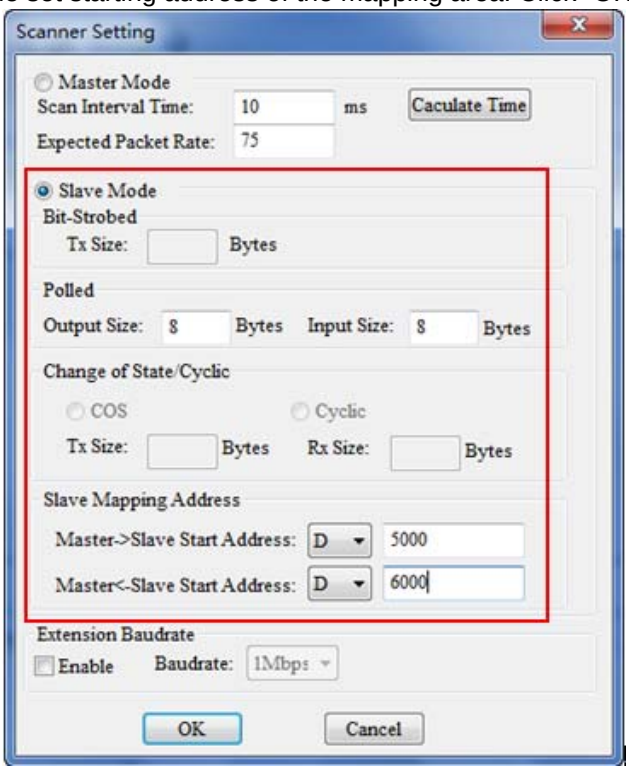


Note: The driver is built via COMMGR software. See section 8.1.4 in the help file of the DeviceNet Builder software for more.

3. Select “Network” >> “Online” and then the following dialog box appears.

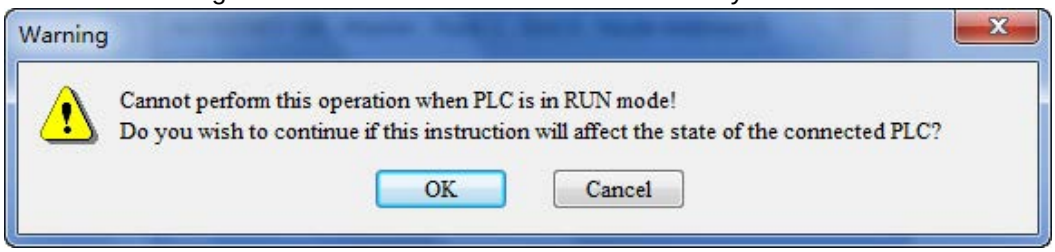


4. Select “Network” >> “Scanner Setting” and then “Scanner Setting” dialog box appears, where “Slave Mapping Address” is for setting the starting address of the mapping area. After selecting “Slave Mode”, fill the set starting address of the mapping area. Click “OK” after setting is over.



Note: “Output Size” and “Input Size” under “Polled” in the above window are used for setting the data length of AH10DNET-5A as the slave.

5. Select “Network” >> “Download” and then the following dialog box appears, where click “OK” to download the configuration data to AH10DNET-5A automatically.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

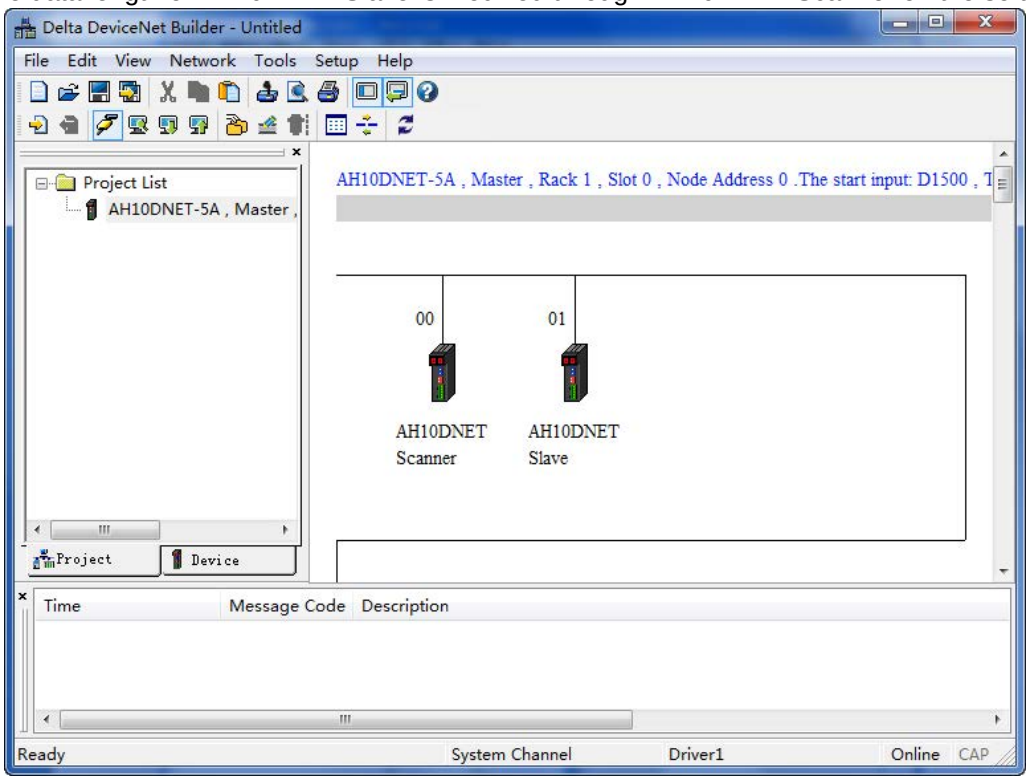
Note: If “E7” is displayed on AH10DNET-5A, please remove its DeviceNet terminals before downloading. Otherwise, failure to download will occur.

6. Power off the AH500 series CPU module and then power it on again after downloading is finished. And at the time, AH10DNET-5A is set to the slave mode.

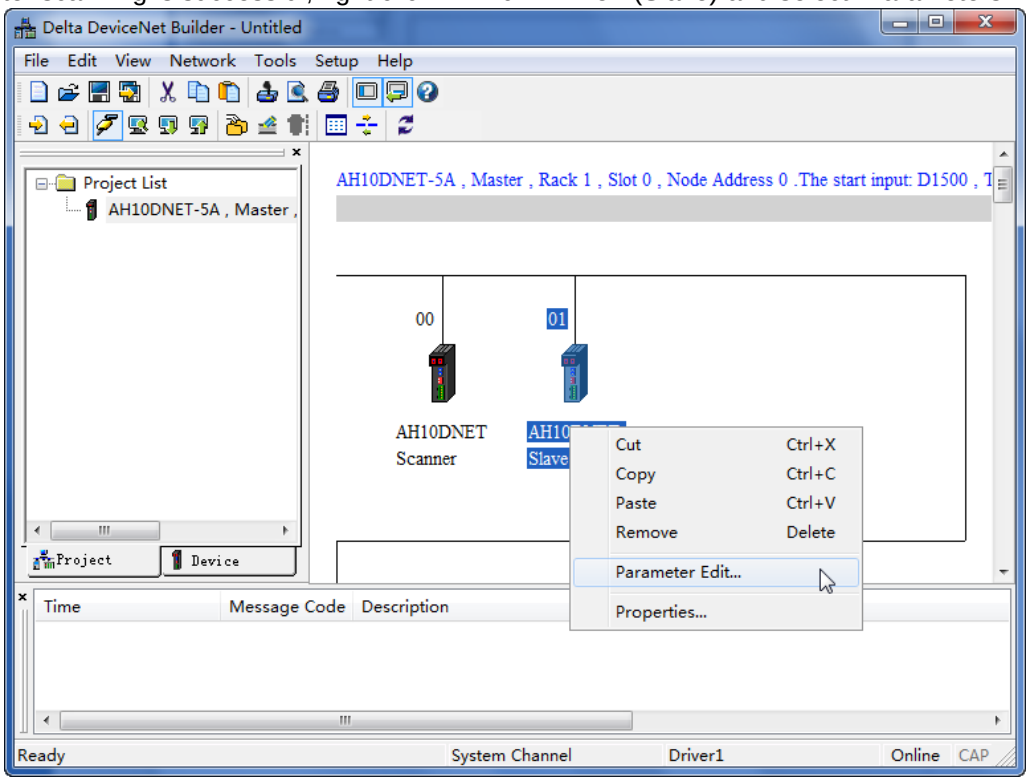
7.8.2 Modifying the Data Length of the Slave

When AH10DNET-5A works in slave mode, the data length could be modified through the software according to the following steps.

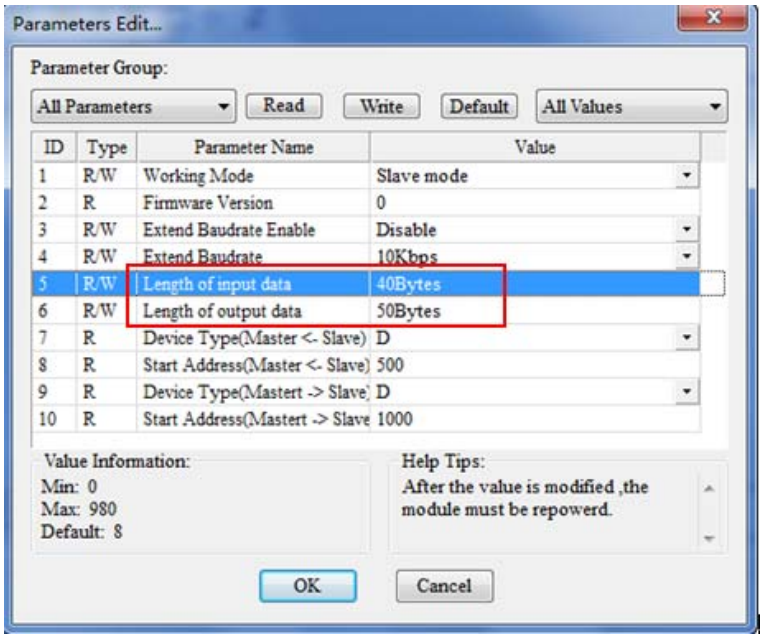
1. Scan AH10DNET-5A in slave mode through the DeviceNet master.
   “AH10DNET Slave” represents for AH10DNET-5A module in slave mode and “AH10DNET Scanner” refers to AH10DNET-5A module in master mode as the following window shows.
   The data length of AH10DNET Slave is modified through AH10DNET Scanner on the software.



2. After scanning is successful, right click “AH10DNET-5A (Slave)”and select “Parameters Edit…”.

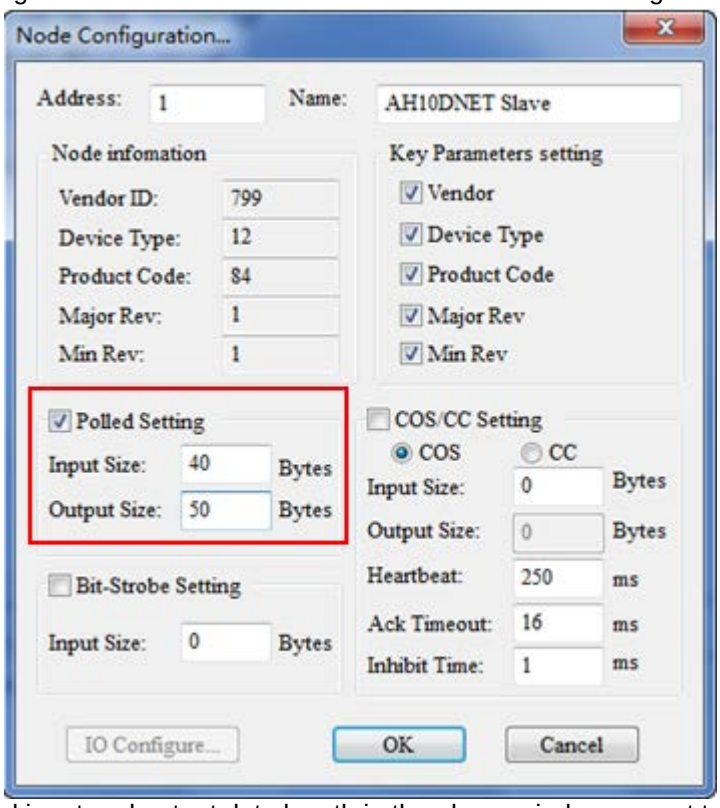


3. Modify the data length of the slave in the parameter editor.
“Length of input data” is the length of the data that the slave sends to the master and “Length of output data” is the length of the data that the master sends to the slave.
The two parameters are used for setting the polled IO data length of the slave and the polled IO data length of AH10DNET Slave can be set in the following window.
After setting is over, click “Write”.



Click “OK” to return the main interface of the software after downloading is completed.
Note: These parameters in the parameter editor belong to the current slave.

4. After returning to the main interface, double click “AH10DNET Slave” icon and then “Node Configuration” dialog box pops up as below. Since the polled input length and output length have been set to 10 bytes when the slave is configured, the two parameters in the following window must be set to 10 bytes. Otherwise, the master will alarm E1 error code which indicates that the data length of the slave does not match after the slave is configured into the master.



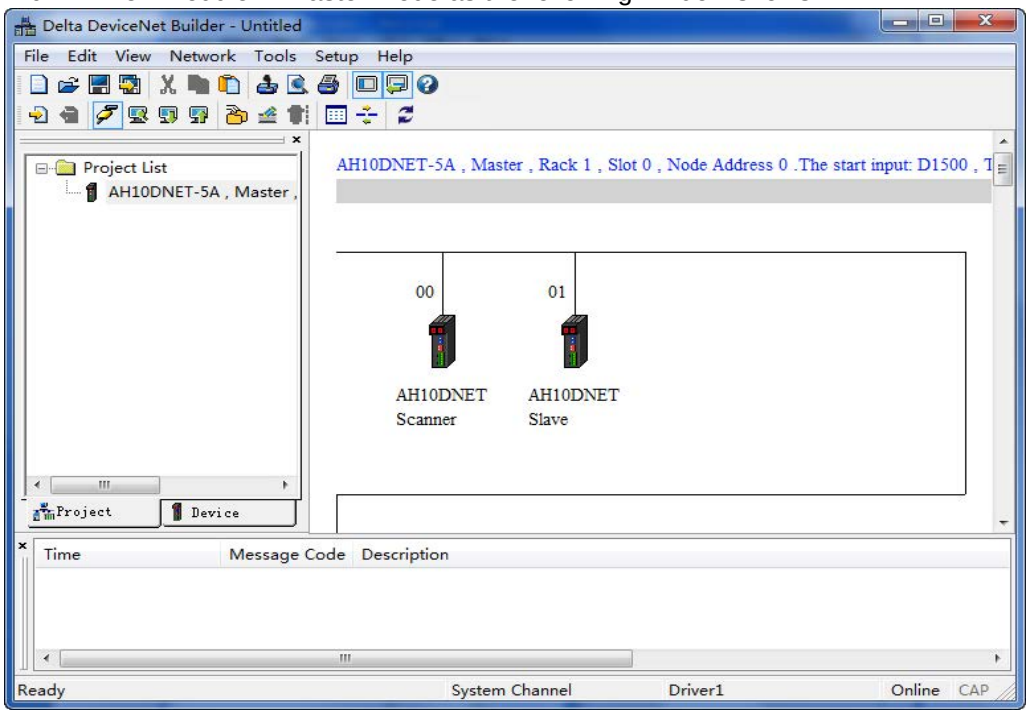
Note: The polled input and output data length in the above window are set to 40 bytes and 50 bytes respectively. After AH10DNET Slave (Node 1) is configured to the scan list, the master will automatically assign 40 bytes of registers in the input list to AH10DNET Slave. Meanwhile, the master will automatically assign 50 bytes of registers in the output list to AH10DNET Slave.

5. Re-power AH10DNET-5A after setting is over and then modifying the data length is successful.

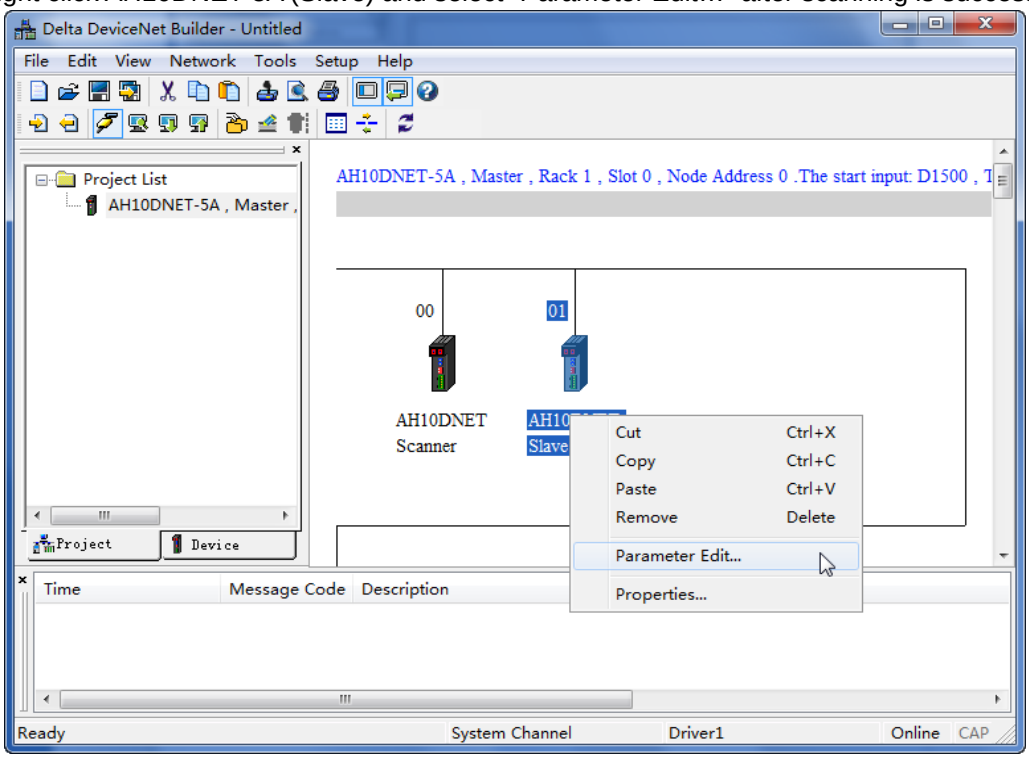
7.8.3 Extension Baud Rate Setting

When AH10DNET-5A is in slave mode, its extension baud rate can be set as the following steps.

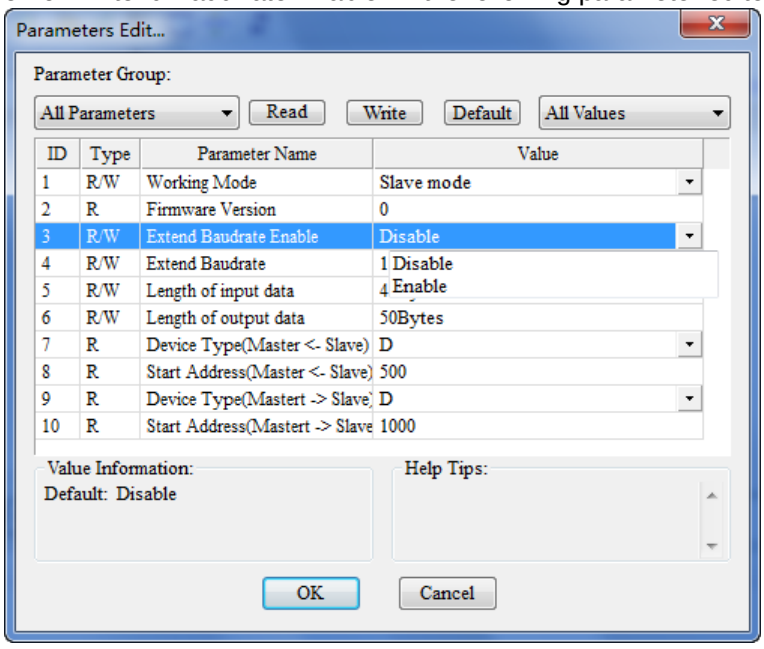
1. Scan AH10DNET-5A in slave mode through the DeviceNet master. “AH10DNET Slave” represents for AH10DNET-5A module in slave mode and “AH10DNET Scanner” refers to AH10DNET-5A module in master mode as the following window shows.



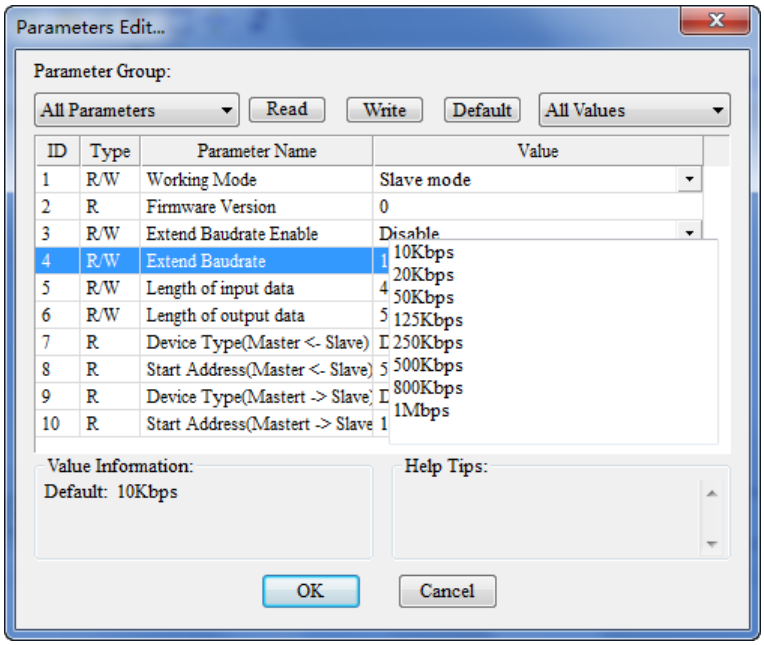
2. Right click AH10DNET-5A (Slave) and select “Parameter Edit…” after scanning is successful.



3. Select “Enable” for “Extend Baud rate Enable” in the following parameter editor.



Meanwhile, select the desired baud rate for “Extend Baud rate” as follows.



Click “OK” to return to the main interface of the software after downloading is completed.
Note: These parameters in the parameter editor belong to the current slave.

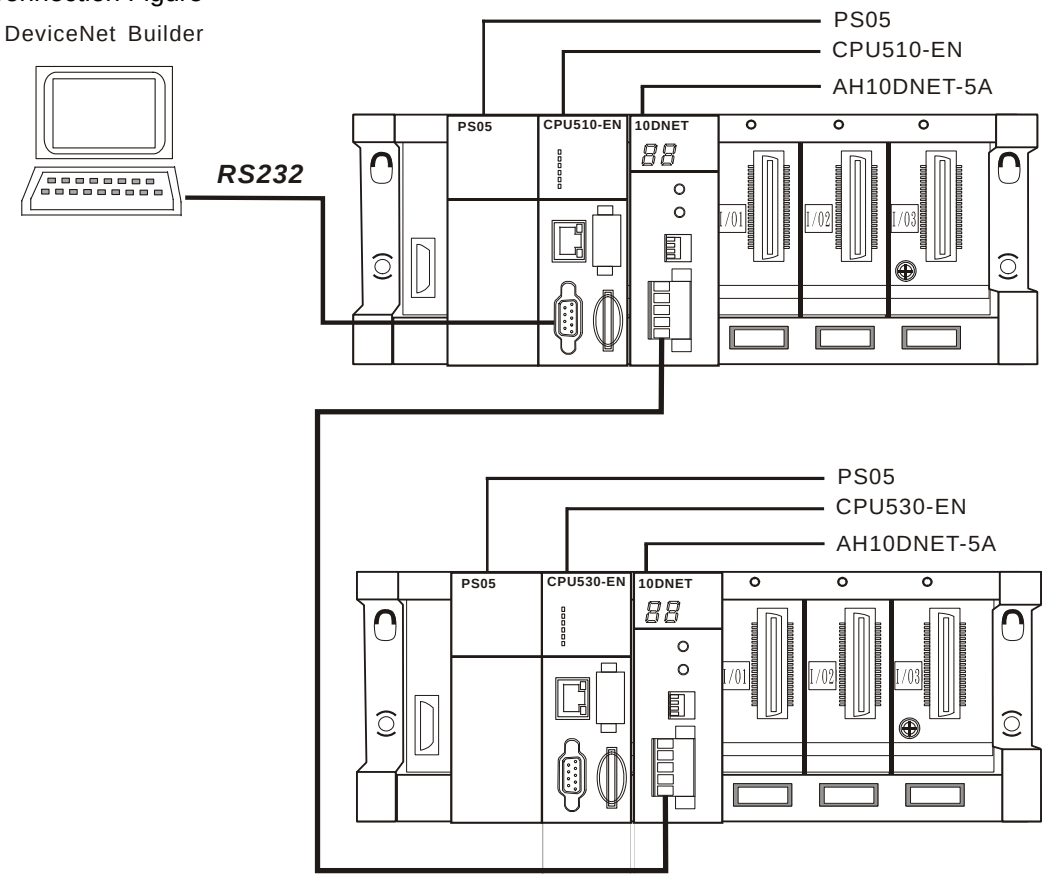
4. After downloading is completed, turn both of the function switch DR0 and DR1 of AH10DNET-5A (Slave) to ON and then re-power the AH500 series CPU module. At the time, the extension baud rate setting is finished.

7.9 Application Example

This section describes how to configure the DeviceNet network in an application example.
Control purpose: AHCPU510-EN can make the remote monitor of D0, D30, D50, D150 and D230 in AHCPU530-EN via the DeviceNet bus.

7.9.1 Constructing One DeviceNet Network

1. Connection Figure



Note:

(1) AHCPU510-EN and AHCPU530-EN both are Delta AH500 series CPU modules. AHCPU510-EN and AH10DNET-5A constitute the DeviceNet master and AHCPU530-EN and AH10DNET-5A constitute the DeviceNet slave.

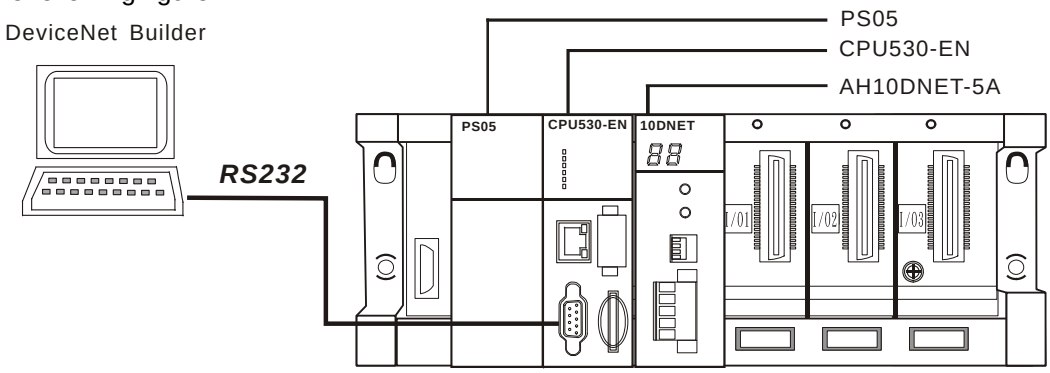
(2) Either end of the DeviceNet bus must be connected with one terminal resistor of about 121ohm. (The resistor should be connected between CAN_H and CAN_L. See section 6.3.4 for more details.)

2. Set up the two AH10DNET-5As according to the following table.

DeviceNet device	Node address	Communication rate
AH10DNET-5A (On the right of AHCPU510-EN)	0	500 kbps
AH10DNET-5A (On the right of AHCPU530-EN)	1	500 kbps

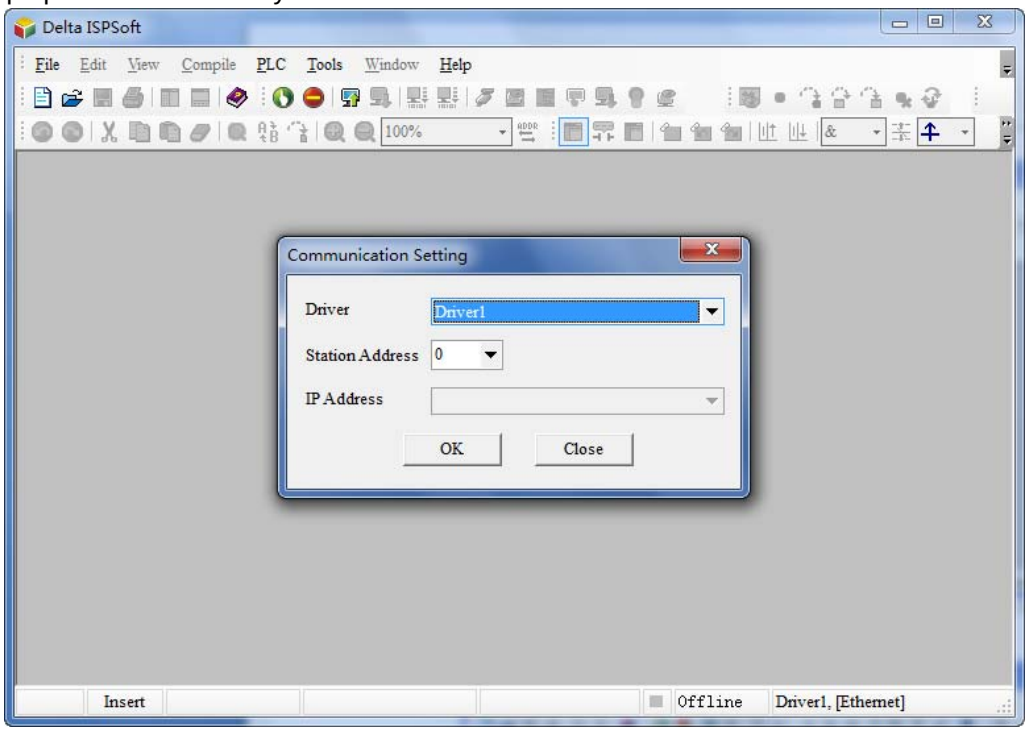
7.9.2 Configuration of DeviceNet Slave

1. PC accesses an AH500 series CPU module via RS232 after connecting the device according to the following figure.

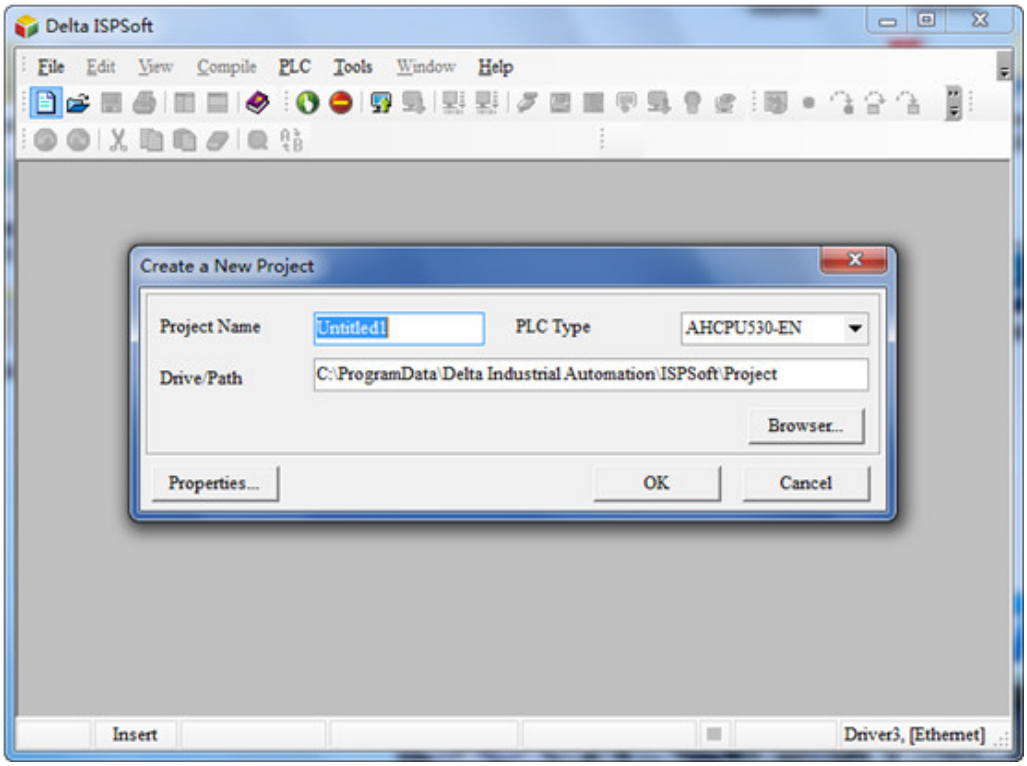


Note: AH10DENT-5A on the right of AHCPU530-EN will serve as the slave and therefore the RS232 communication cable must be connected to AHCPU530-EN.

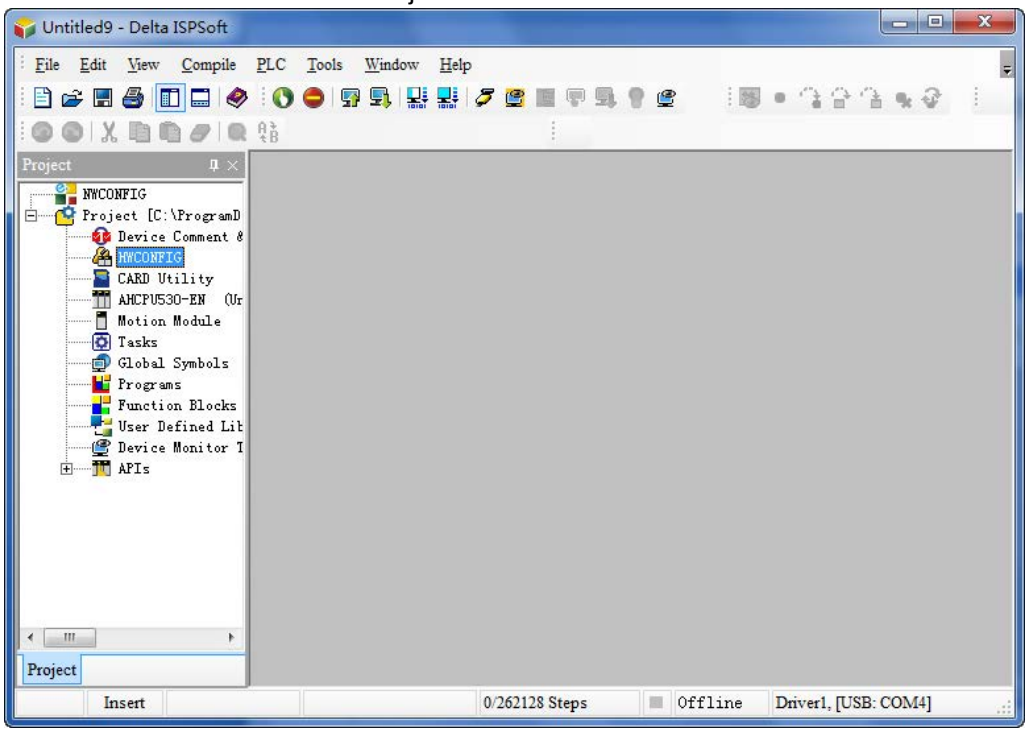
2. Open ISPSoft; select “Tool” >> “Communication Setting” and then the following dialogue box will pop up. Select the already built driver and then click “OK”.



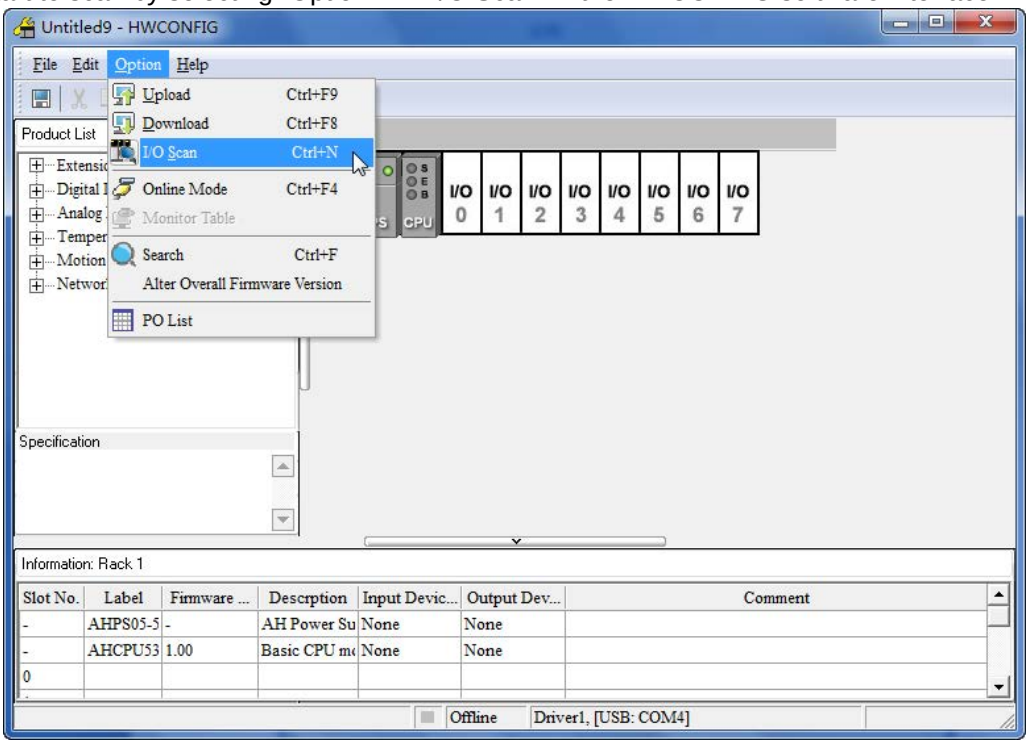
3. Select “File” >> “New” >> “New” and the following dialogue box will appear. Click “OK” after selecting the corresponding PLC model.



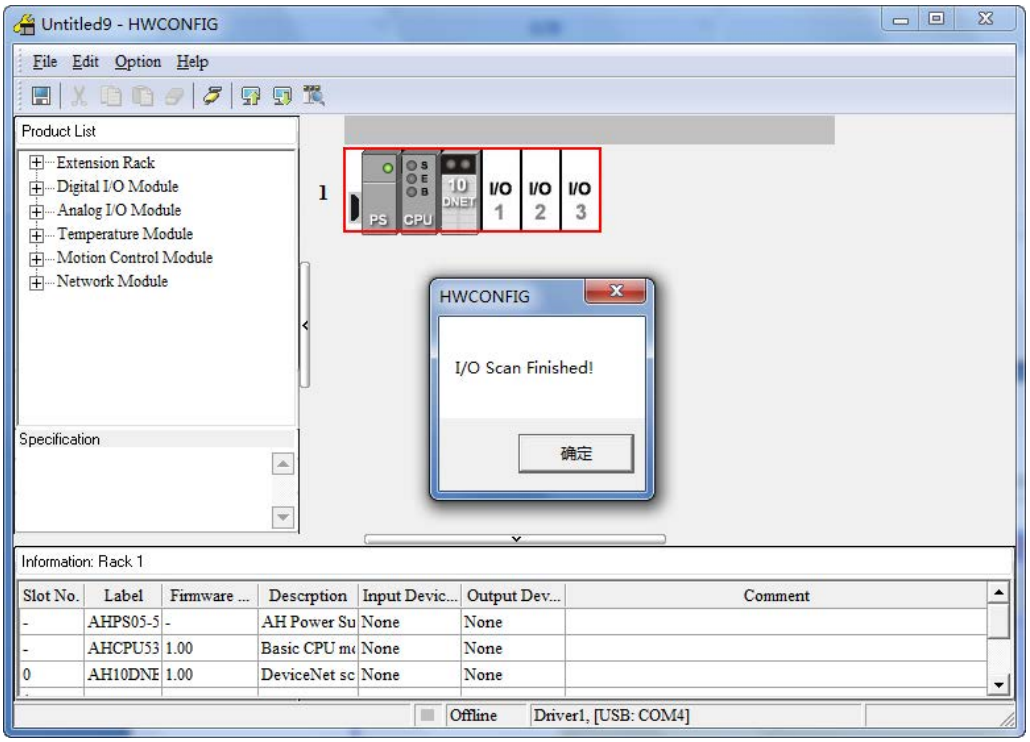
4. Double click HWCONFIG under “Project” and the HWCONFIG software interface is called out.



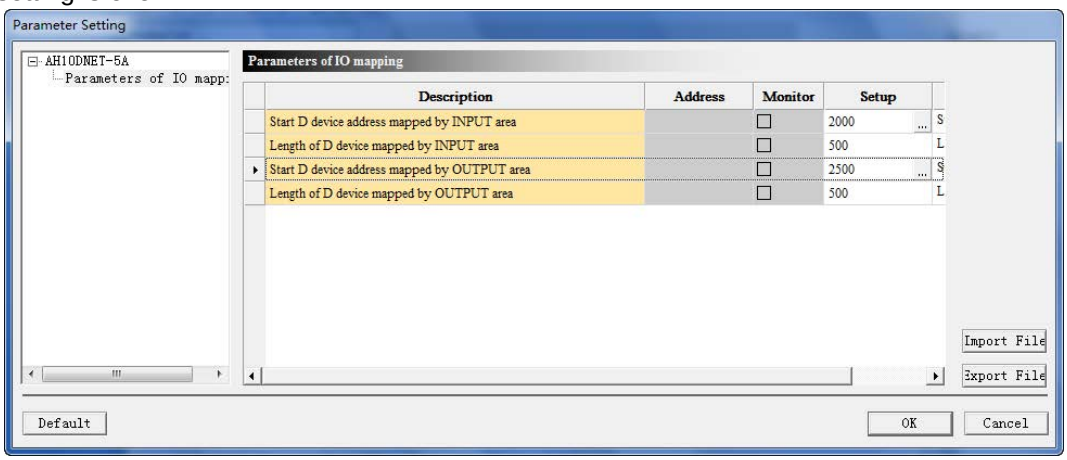
5. Start to scan by selecting “Option” >> “I/O Scan” in the HWCONFIG software interface.



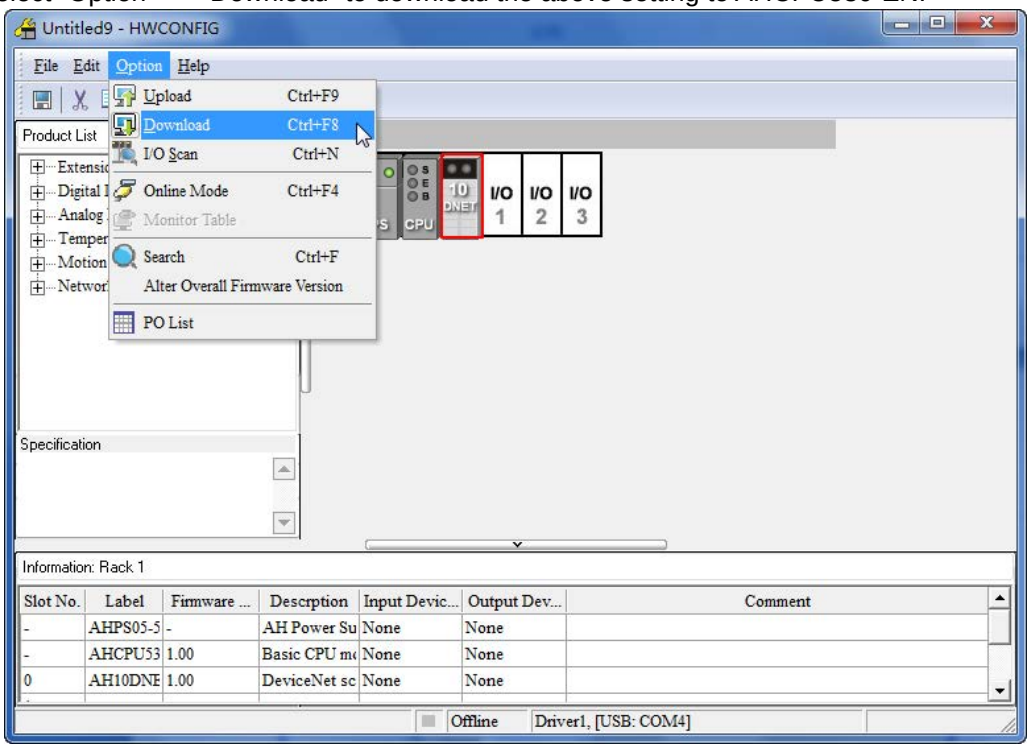
The device connected to AHCPU530-EN will be scanned.



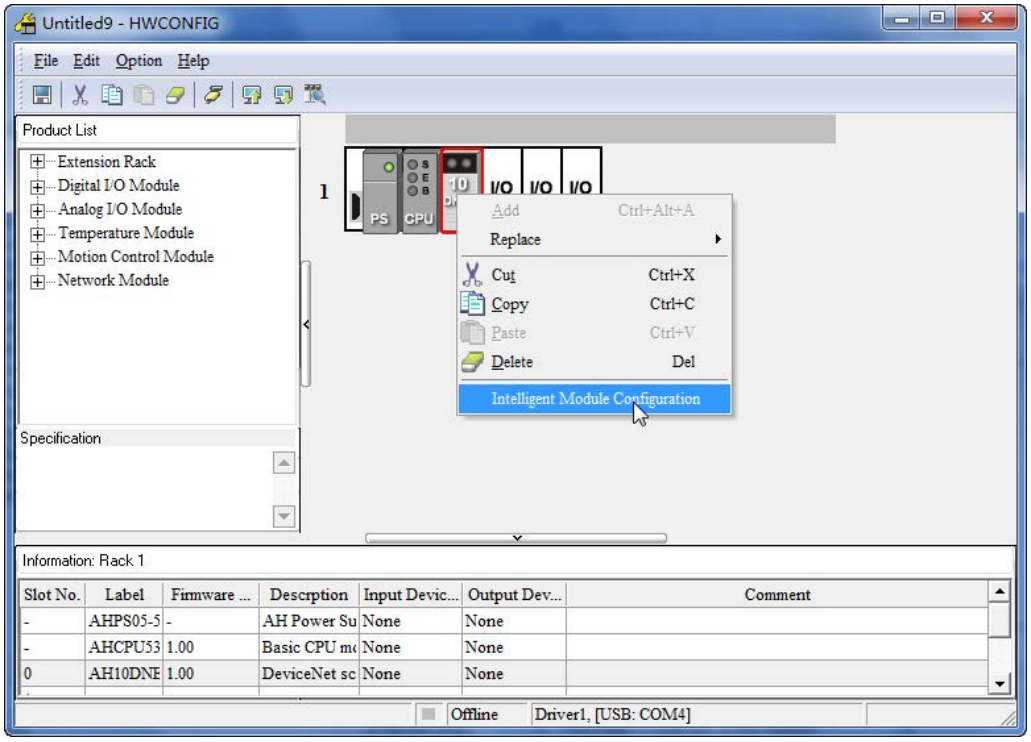
6. 10DNET in the window is the abbreviation of AH10DNET-5A. Double click the icon of 10DNET and then the parameter setting window of 10DNET will pop up.
   Set the mapping starting address of D in the INPUT area (the initial input mapping address) and the OUTPUT area (The initial output mapping address).
   In this example, the two addresses are set to D2000 and D2500 respectively. Click “OK” after setting is over.



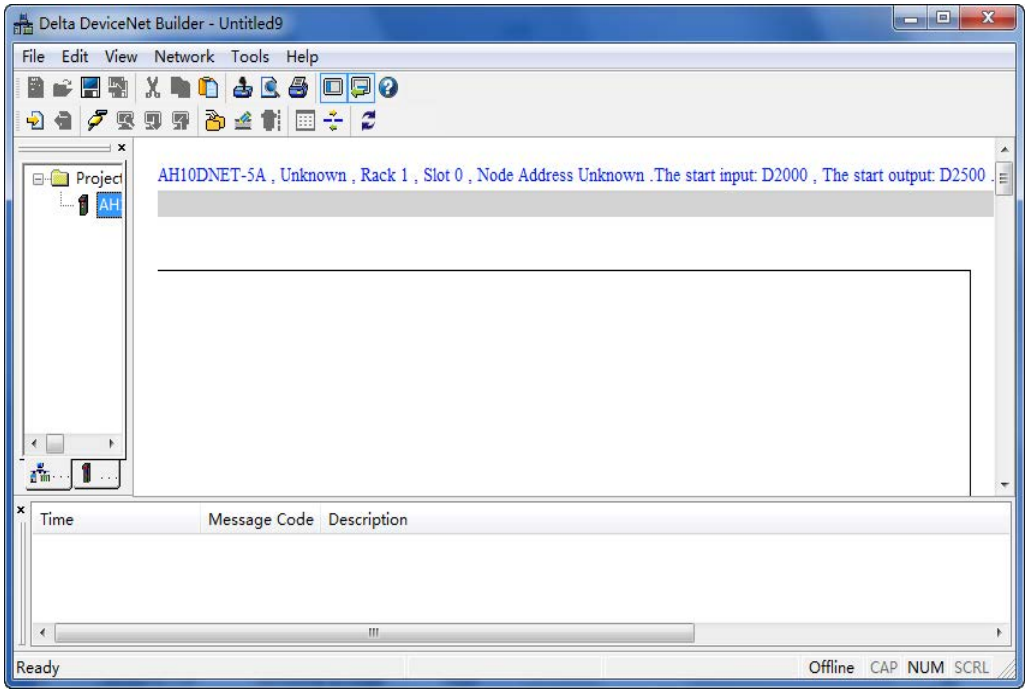
7. Select “Option” >> “Download” to download the above setting to AHCPU530-EN.



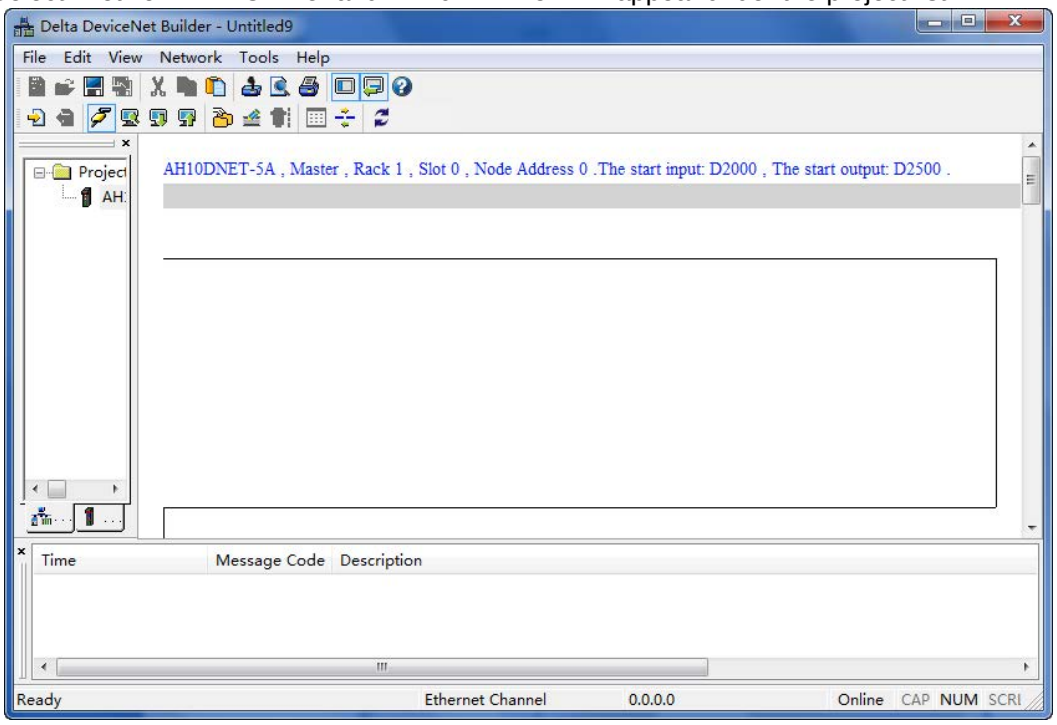
8. Right click 10DNET icon and select “Intelligent Module Configuration” to call the DeviceNet Builder software interface out.



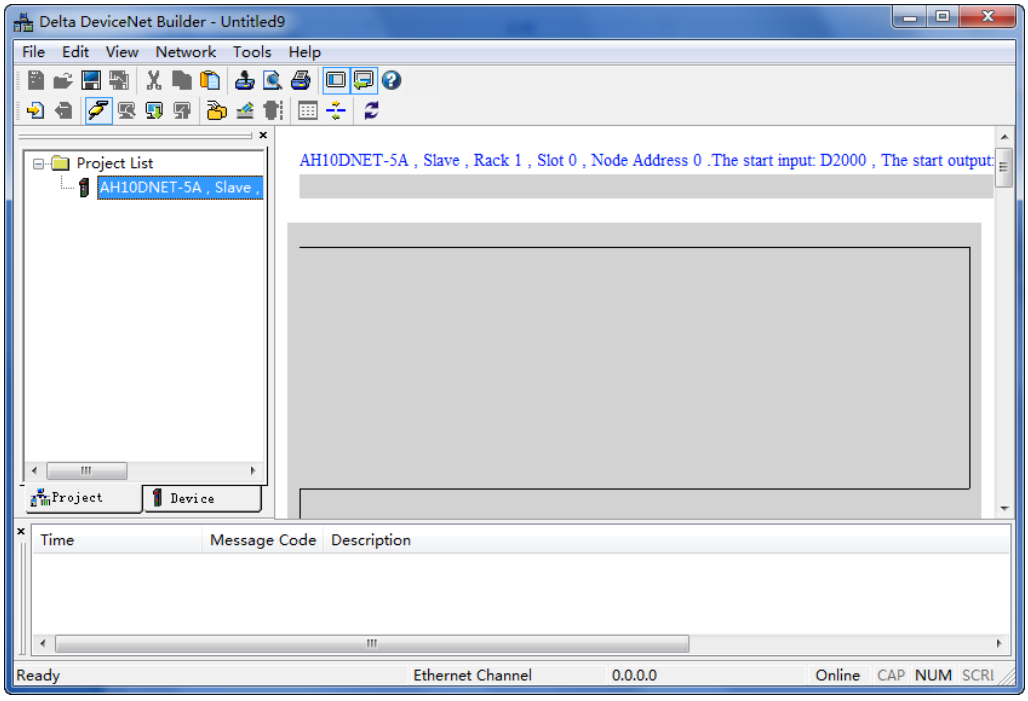
9. The DeviceNet Builder software is called out.


Delta DeviceNet Builder - Untitled9
File Edit View Network Tools Help
Project
AH
AH10DNET-5A , Unknown , Rack 1 , Slot 0 , Node Address Unknown .The start input: D2000 , The start output: D2500 .
Time
Message Code
Description
Ready
Offline CAP NUM SCRL

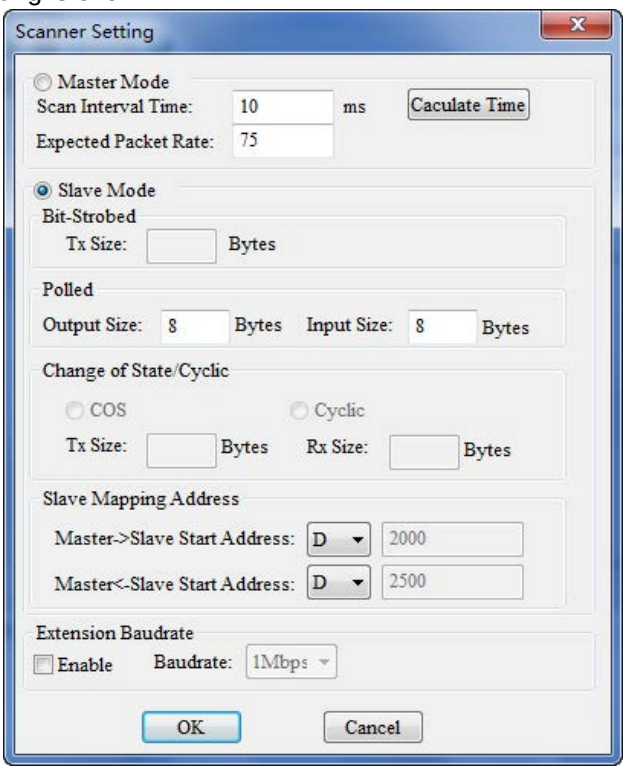
10. Select “Network” >> “Online” and AH10DNET-5A will appear under the project list.



If current AH10DNET-5A has been set to the slave mode, the software interface will be as shown below.

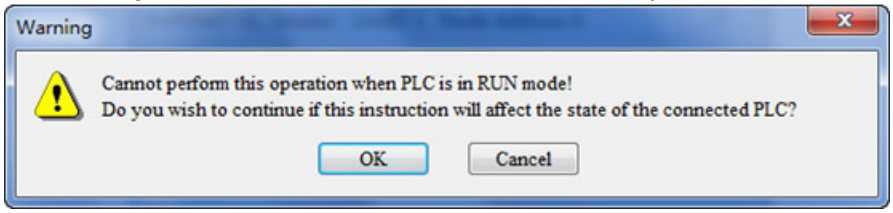


11. Select “Network” >> “Scanner Setting” and “Scanner setting” dialogue box pops up. Select “Slave Mode” and fill the data length of the slave and the mapping address of the device.
    In this example, AHCPU510-EN monitors 5 registers in AHCPU530-EN and therefore the output length and input length are both set to 10 bytes. “Master -> Slave Start Address” and “Master <- Slave Start Address” are set to D2000 and D2500 respectively. The two addresses are specified by ISPSoft in the above step. But users could modify them.
    Click “OK” after setting is over.



    Note:
    (1) “Output length” and “Input length” are for specifying the data length when AH10DNET-5A serves as the slave.
    (2) “Master -> Slave Start Address” is used for setting the mapping starting address for output as AH10DNET-5A is in slave mode and the data that the master sends out will be updated in the area.
    “Master <- Slave Start Address” is used for setting the mapping starting address for input as AH10DNET-5A is in slave mode and the data in these registers will be transmitted to the master in real time. In the DeviceNet software, the starting address of AH10DNET-5A (slave) can be modified only here.
    (3) In the configuration interface, AH10DNET-5A can be set to the master mode or slave mode.

12. Select “Network” >> “Download” and the following dialogue box pops up. Click “OK” to download the configuration data to AH10DNET-5A automatically.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

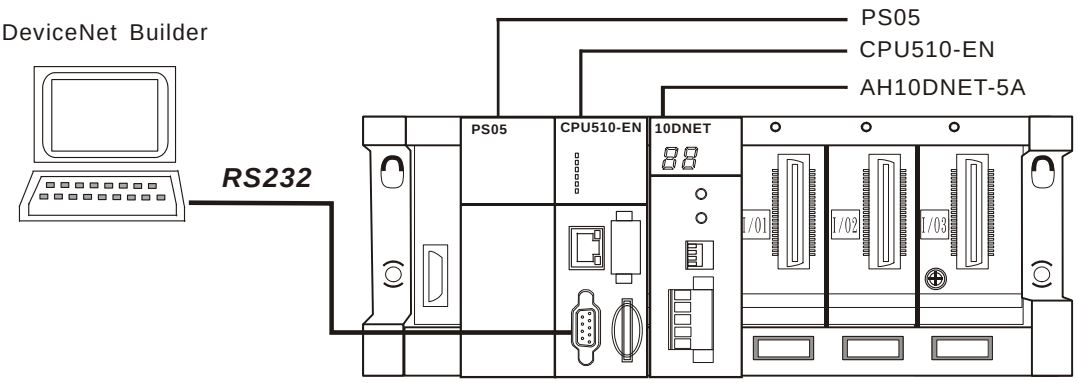
    Note: If E7 appears on AH10DNET-5A, please remove the DeviceNet terminal before downloading. Otherwise, Failure to download will occur.

13. After downloading is completed, power off the AH500 series CPU module and then re-power it. At the moment, AH10DNET-5A is set to the slave mode.

Note: Pick “Master Mode” in step 11; follow the steps and AH10DNET-5A will be set to the master mode.

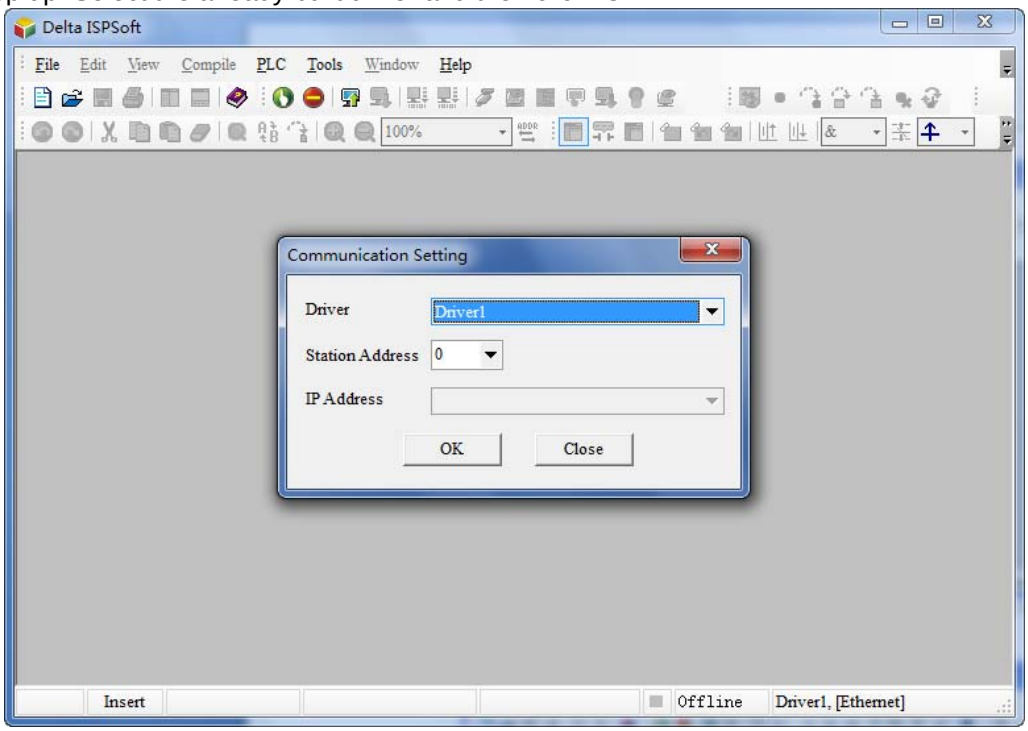
7.9.3 Configuration of DeviceNet Master

1. Connect the devices following the figure below and remove the RS232 cable from AHCPU530-EN to AHCPU510-EN.

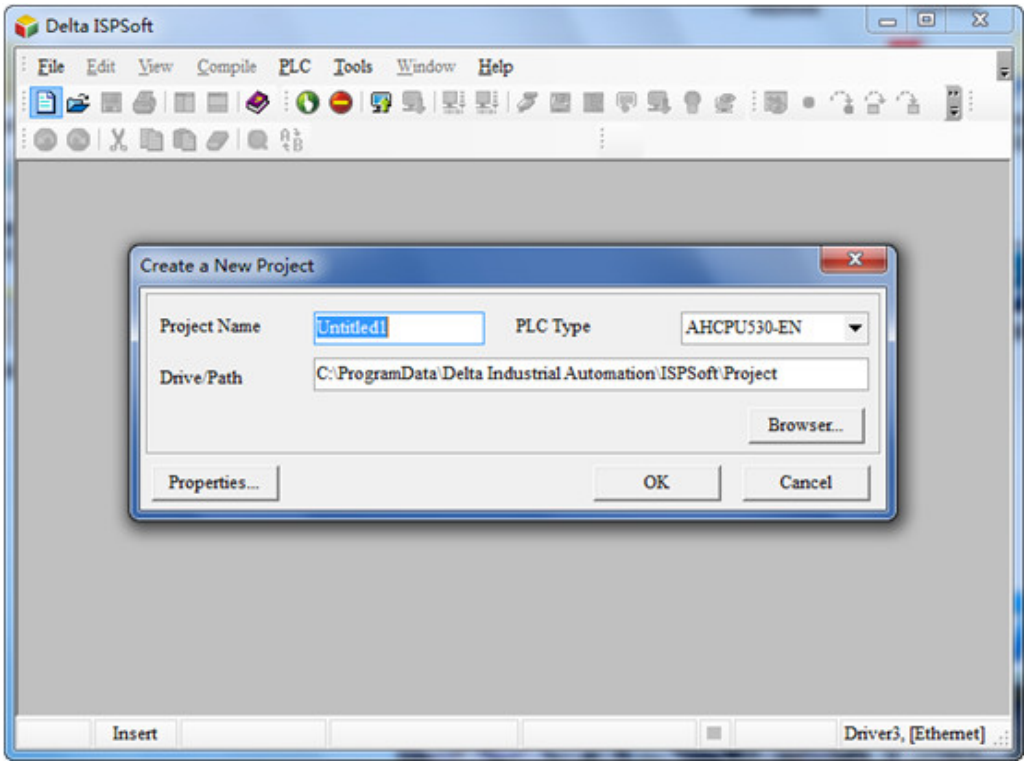


Note: AH10DENT-5A on the right of AHCPU510-EN is used as the master and therefore the RS232 cable must be connected to AHCPU510-EN.

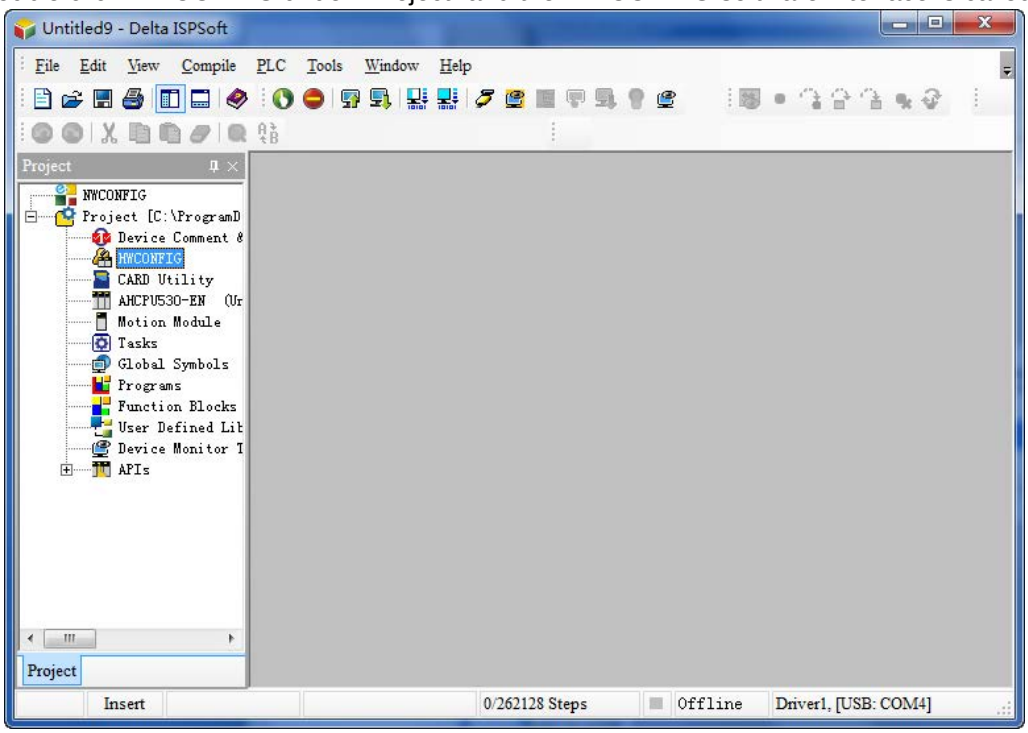
2. Open ISPSoft; select “Tool” >> “Communication Setting” and then the following dialogue box will pop up. Select the already built driver and then click “OK”.



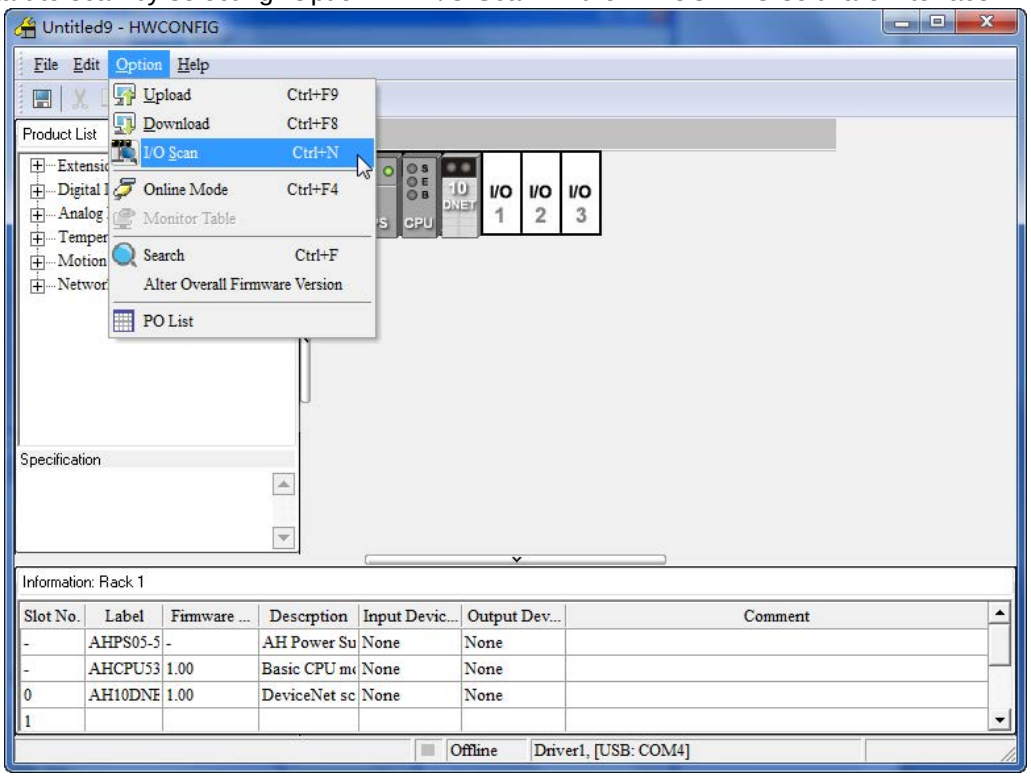
3. Select “File” >> “New” >> “New” and the following dialogue box will appear. Click “OK” after selecting the corresponding PLC model.



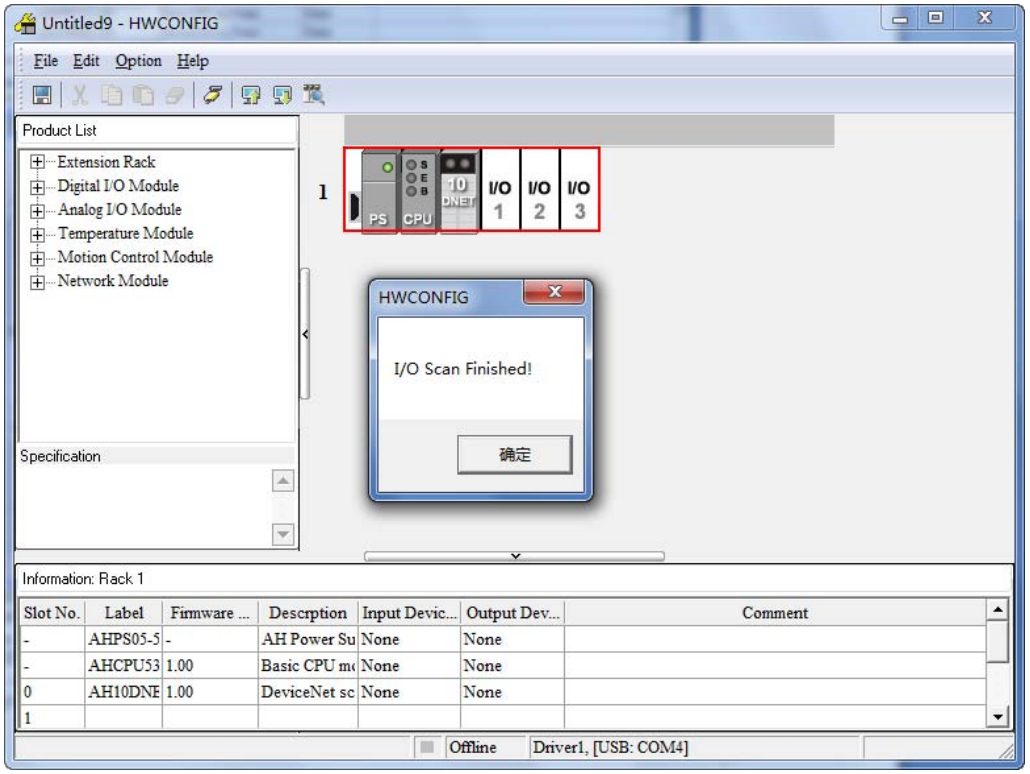
4. Double click HWCONFIG under “Project” and the HWCONFIG software interface is called out.



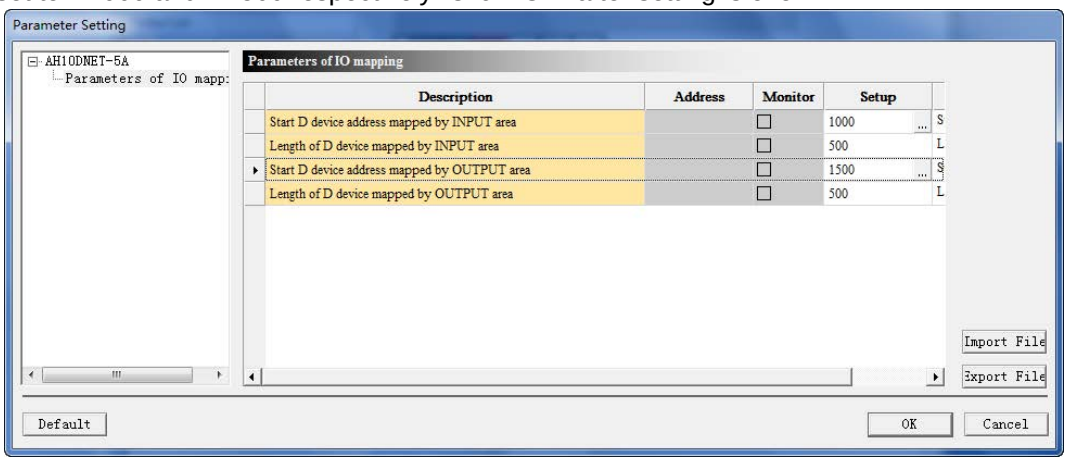
5. Start to scan by selecting “Option” >> “I/O Scan” in the HWCONFIG software interface.



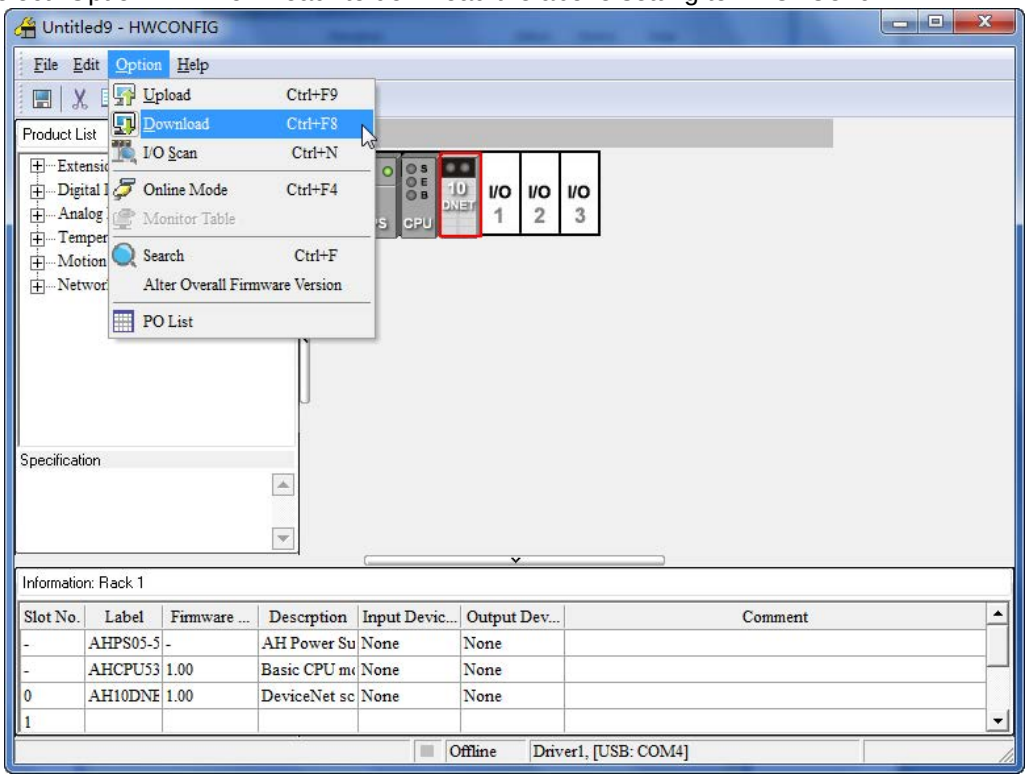
The device connected to AHCPU510-EN is scanned.



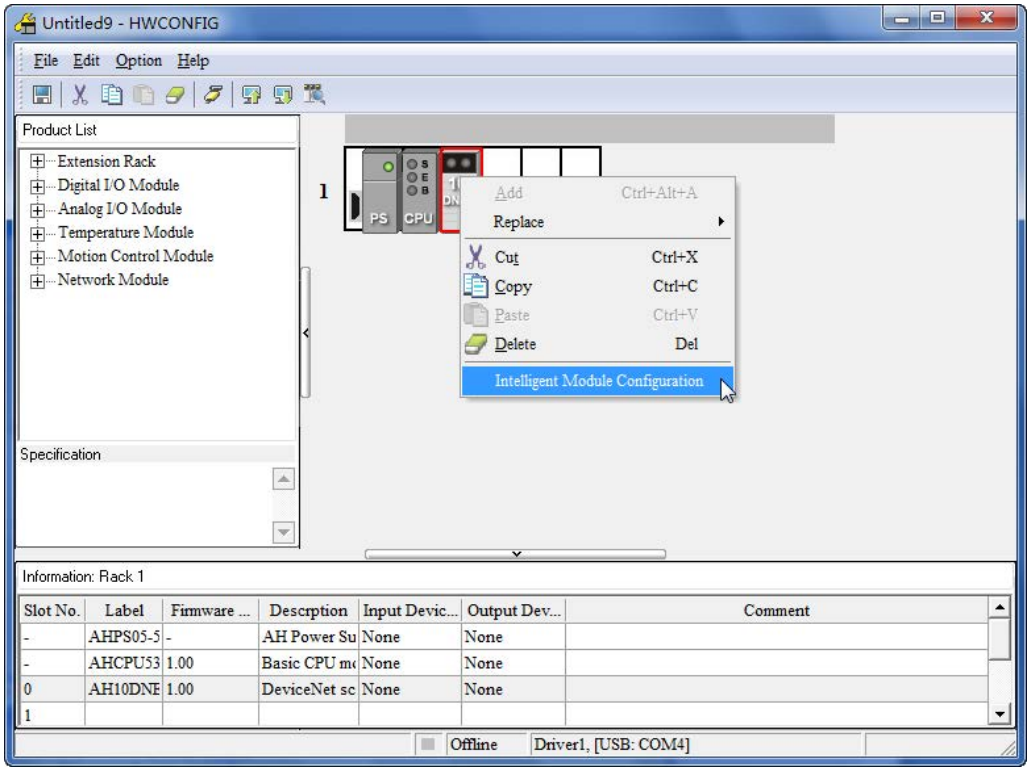
6. 10DNET in the window is the abbreviation of AH10DNET-5A. Double click the icon of 10DNET and then the parameter setting window of 10DNET will pop up.
   Set the mapping starting address of D in the INPUT area (the initial input mapping address) and the OUTPUT area (the initial output mapping address). In this example, the two addresses are set to D1000 and D1500 respectively. Click “OK” after setting is over.



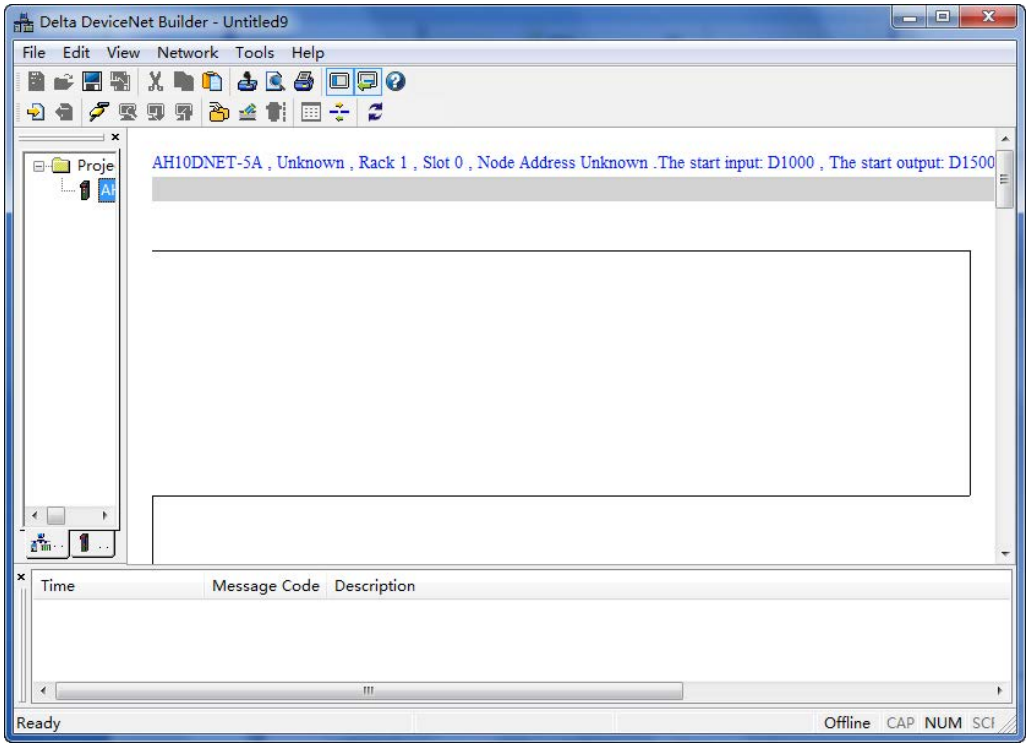
7. Select “Option” >> “Download” to download the above setting to AHCPU510-EN.



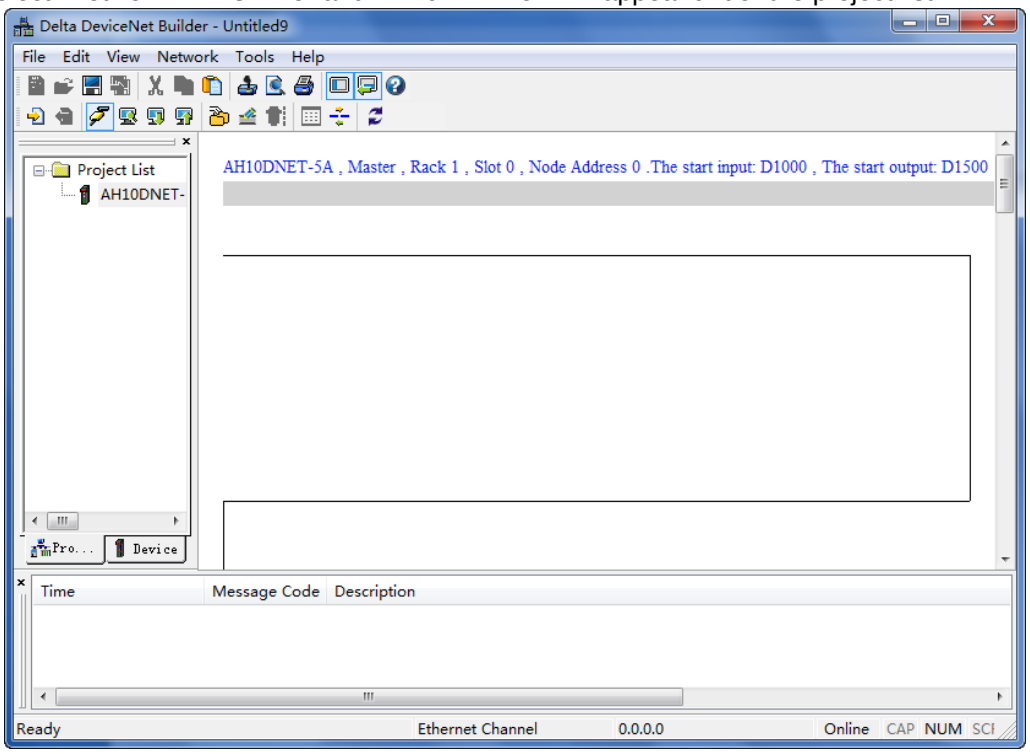
8. Right click 10DNET icon and select “Intelligent Module Configuration” to call the DeviceNet Builder software interface out.



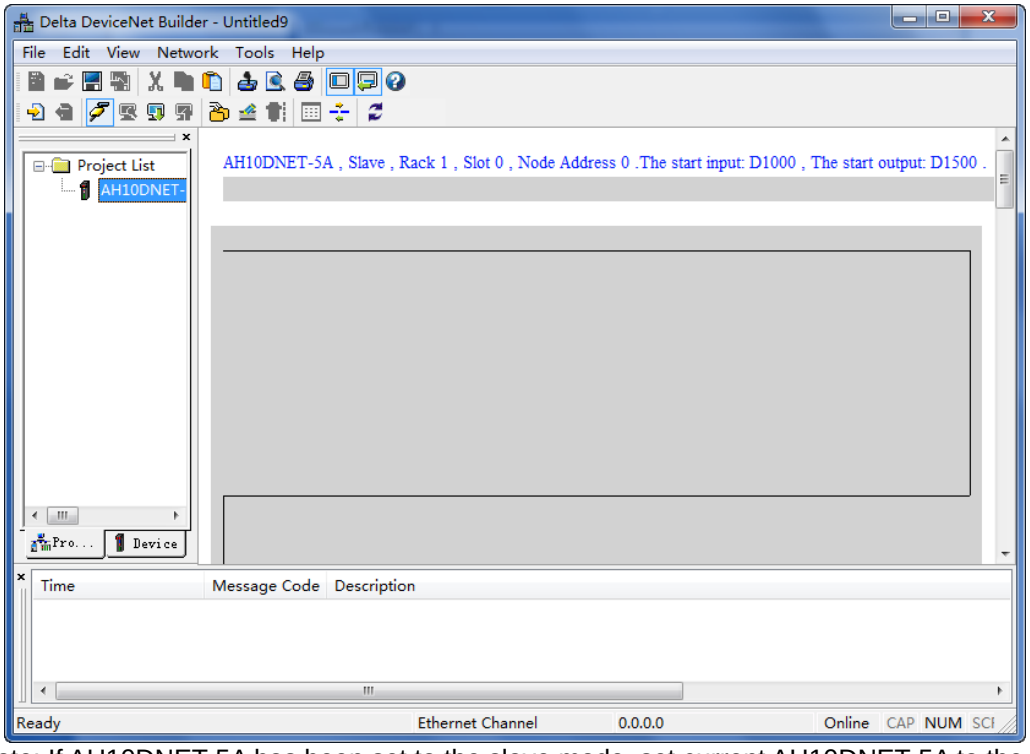
9. The DeviceNet Builder software is called out.


Delta DeviceNet Builder - Untitled9
File Edit View Network Tools Help
AH10DNET-5A , Unknown , Rack 1 , Slot 0 , Node Address Unknown .The start input: D1000 , The start output: D1500
Time
Message Code
Description
Ready
Offline CAP NUM SCI

10. Select “Network” >> “Online” and AH10DNET-5A will appear under the project list.

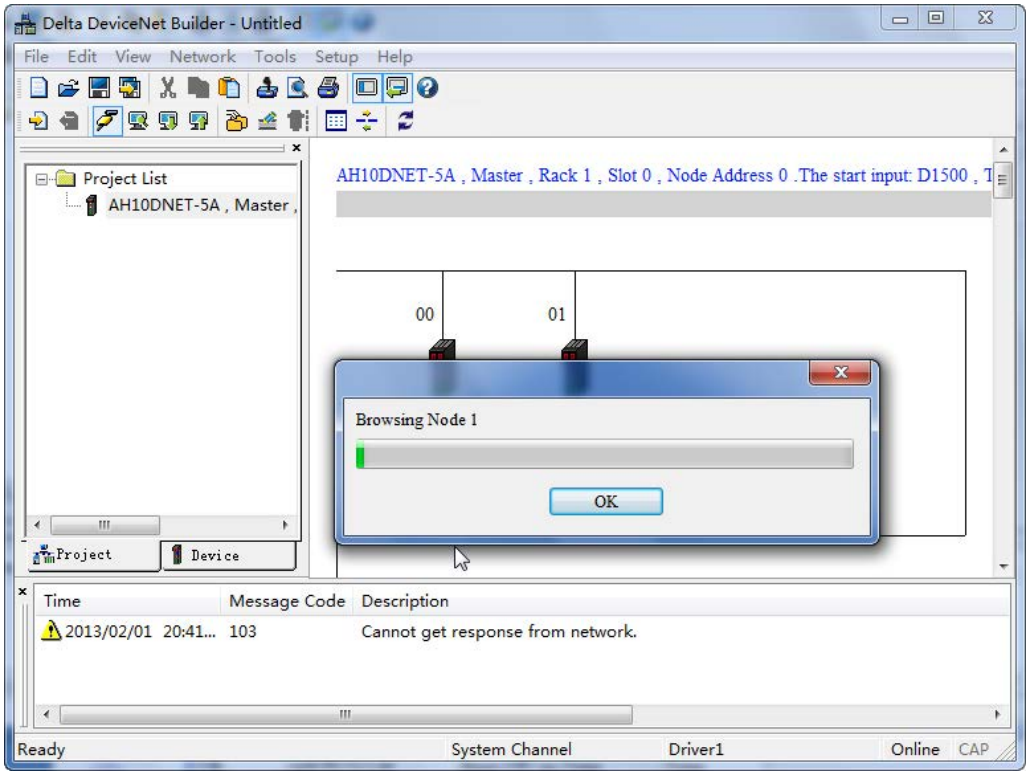


If AH10DNET-5A has been set to the slave mode, the software interface will be as shown below.

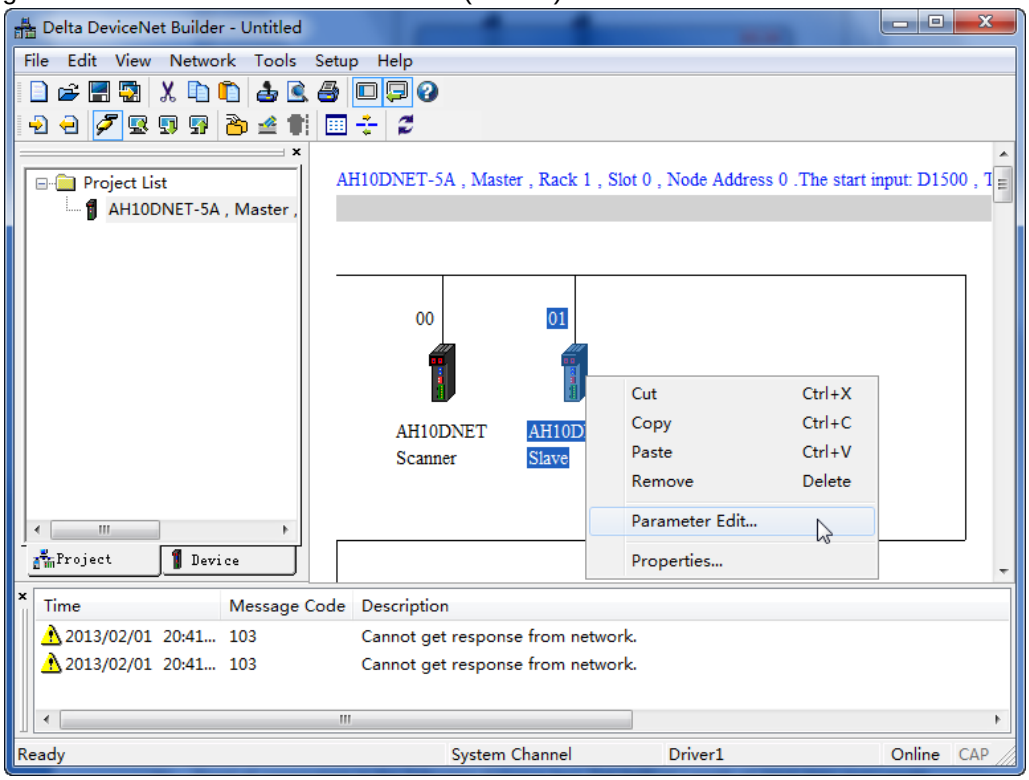


Note: If AH10DNET-5A has been set to the slave mode, set current AH10DNET-5A to the master mode first and then conduct the next operation.

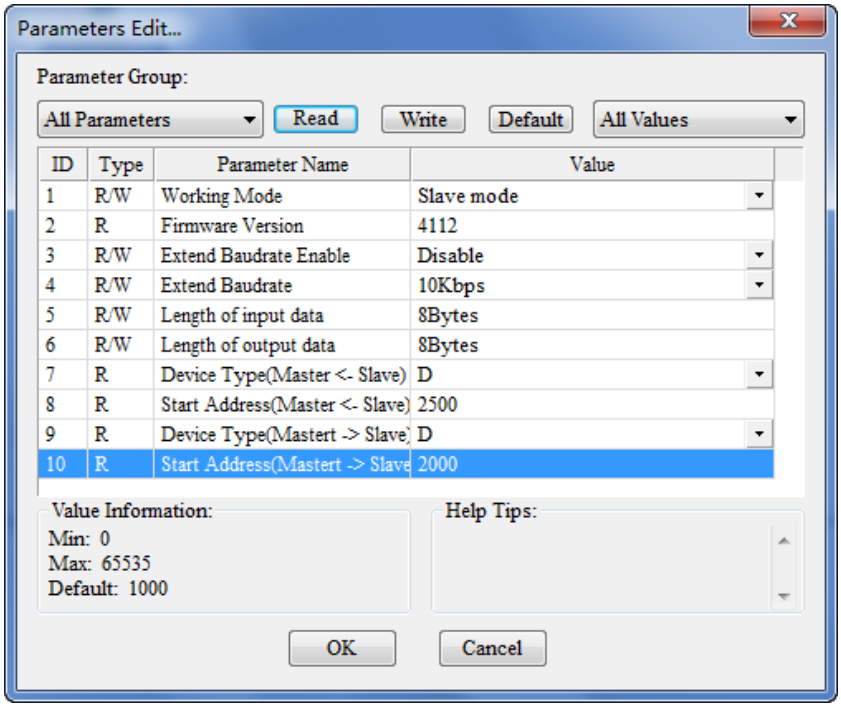
11. Select “Network” >> “Scan DeviceNet Network” and AH10DNET-5A starts to scan the whole network. All the node icons and device names on the network will be displayed on the software as below.



12. Right click the icon on AH10DNET Slave (node 1) and select “Parameter Edit...”.

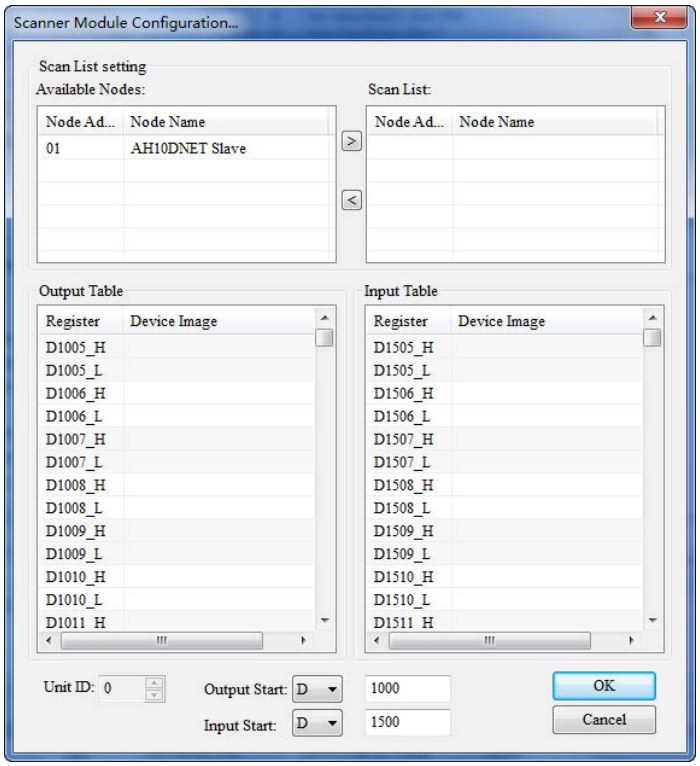


13. Read all parameters in the following dialogue box. Set both of Length of input data and Length of output data of the slave to 10 bytes. After reading is over, click “OK” to return to the main interface of the software.

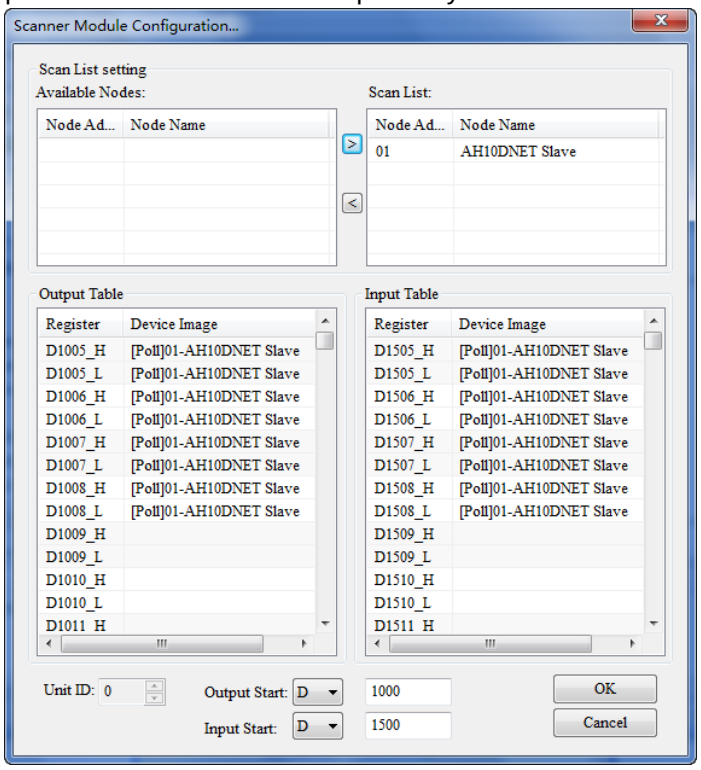


7.9.4 Configuring DeviceNet Slave into the Master

1. Double click AH10DNET Scanner (Node 1) on the main software interface and “Scanner Module Configuration” dialog box appears, where see the currently available node AH10DNET Slave in the left list.



2. Add the node device in “Available Nodes” to Scan List. In the example, the starting addresses for output and input are D1500 and D1000 respectively.



Note:

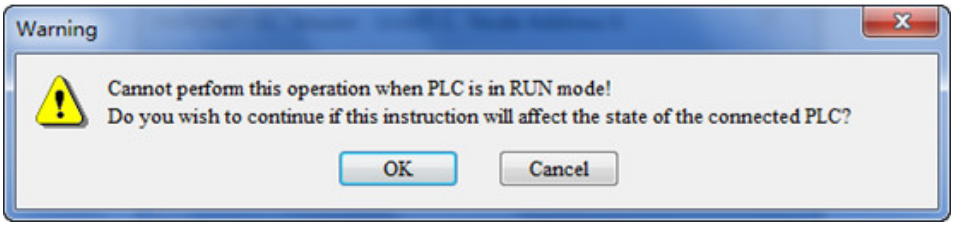
(1) After the connection between the master and slave is built successfully, fill the control data in the registers in “Output Table” and the data will be transmitted to the slave automatically.

(2) After the connection between the master and slave is built successfully, the data that slave feedback will be transmitted to the registers in “Input Table”.

(3) The registers in “Output Table” are specified by “Output Start”.

(4) The registers in “Input Table” are specified by “Input Start”.

3. Click “OK” after confirming that no error exists to download the configuration to AH10DNET-5A. If AH500 is in run mode during downloading, the warning dialogue box will pop up as below.


Warning
Cannot perform this operation when PLC is in RUN mode!
Do you wish to continue if this instruction will affect the state of the connected PLC?
OK
Cancel

4. Click “OK” to download the configuration to the scanner module. At the moment, the configuration of the DeviceNet network is completed.

7.9.5 Data Flow Direction

Configure the DeviceNet network following the above steps and the mapping relation between AH10DNET-5A and the slave device is shown below:

AH500 → AH10DNET-5A → Slave device

AH510	AH10DNET-5A (Master)	AH10DNET-5A (Slave)	AH530
D1505			D2000
D1506			D2001
D1507	⇨	⇨	D2002
D1508			D2003
D1509			D2004

AH500 ← AH10DNET-5A ← Slave device

AH510	AH10DNET-5A (Master)	AH10DNET-5A (Slave)	AH530
D1005			D2500
D1006			D2501
D1007	⇦	⇦	D2502
D1008			D2503
D1009			D2504

Note: AHCPU510-EN is to monitor and control D0 in AHCPU530-EN via the DeviceNet bus; move the value in D2000 to D0 and meanwhile move the value in D0 to D2500 in AHCPU530-EN in real time.

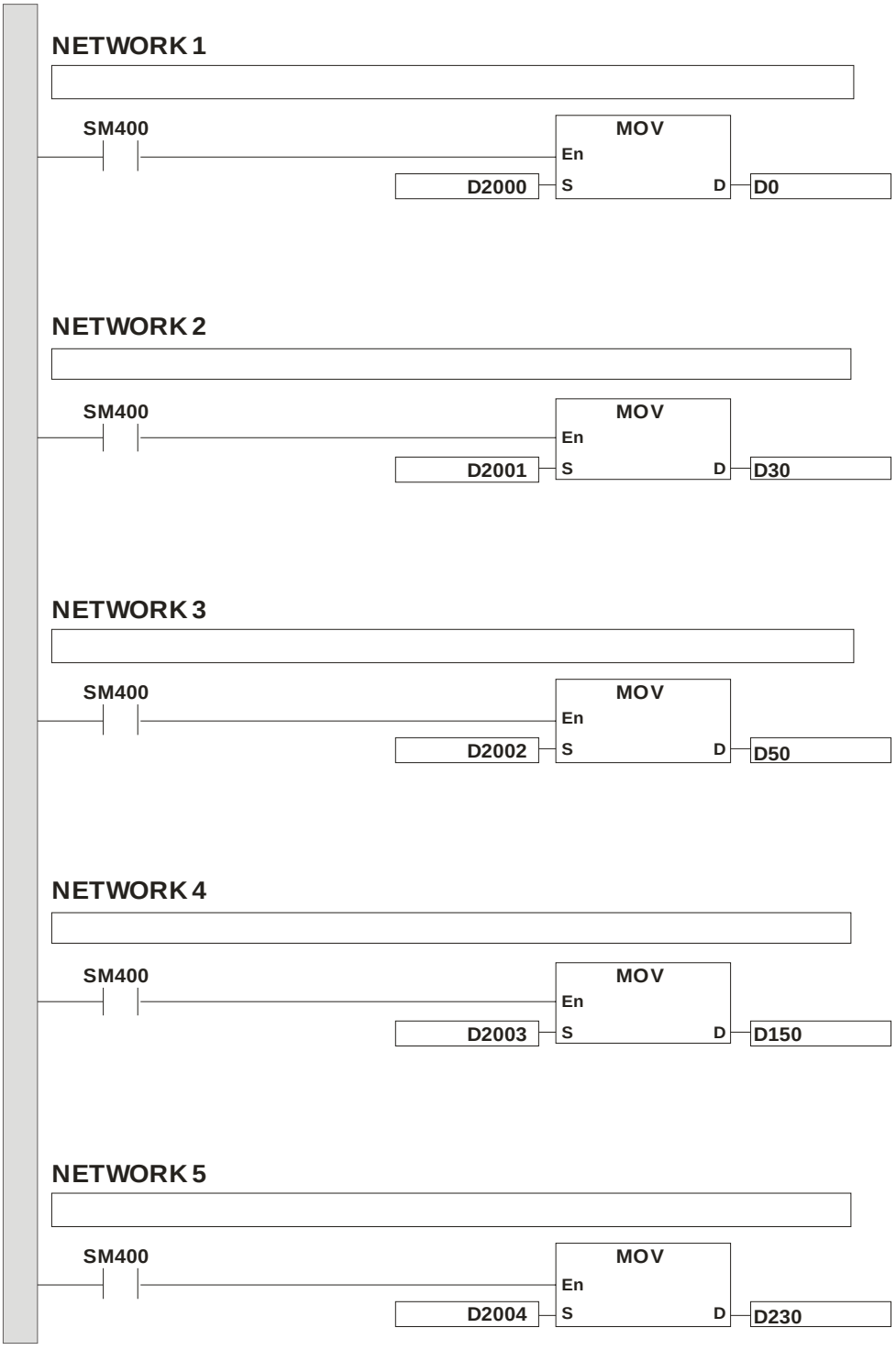
7.9.6 Ladder Diagram Program

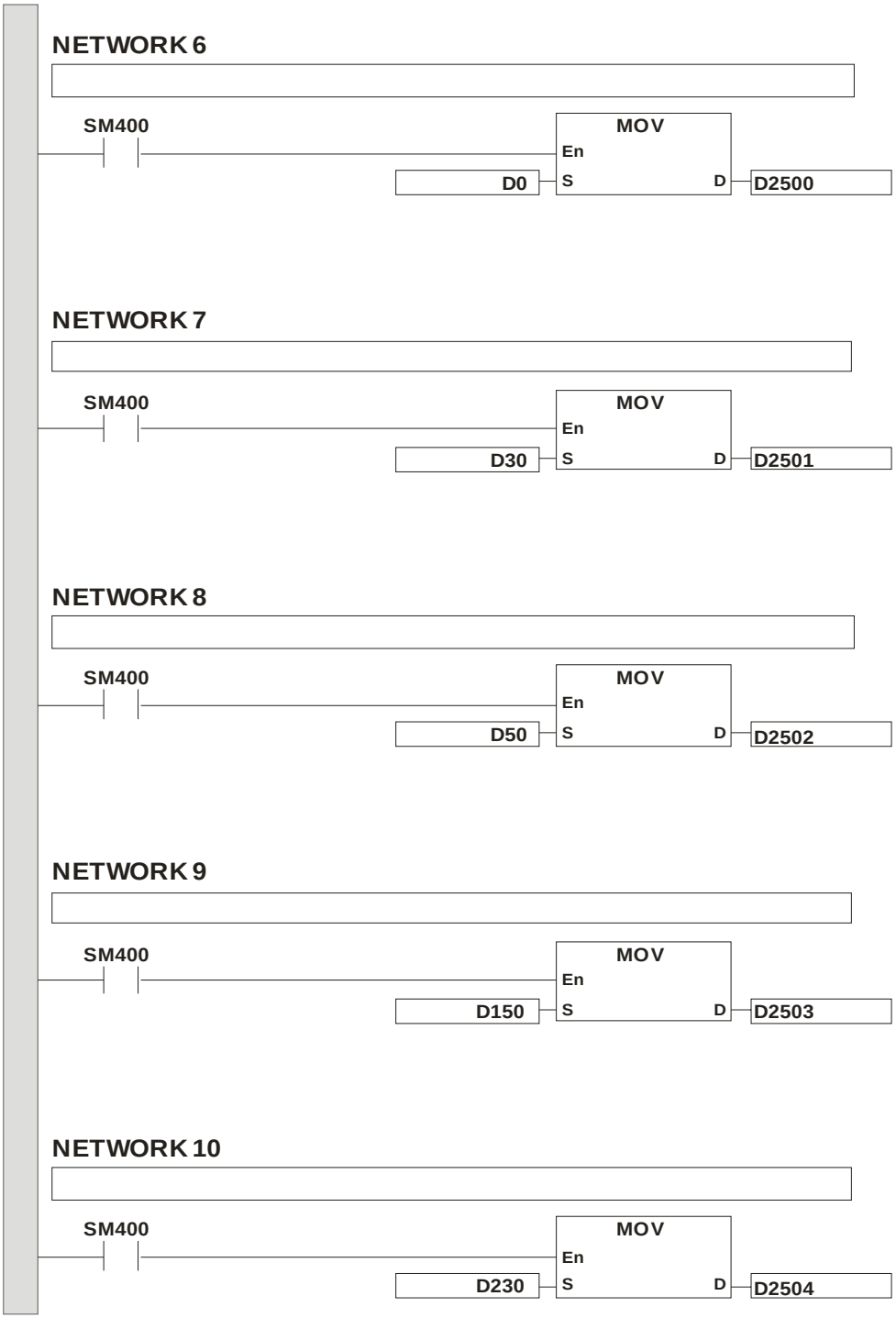
Control request:

AHCPU510-EN makes the remote monitor and control of D0, D30, D50, D150 and D230 in AHCPU530-EN via the DeviceNet bus.

In order to achieve the above control request, write the following PLC program in AHCPU530-EN.

PLC Program:


NETWORK 1
SM400
MOV
En
D2000
S
D
D0
NETWORK 2
SM400
MOV
En
D2001
S
D
D30
NETWORK 3
SM400
MOV
En
D2002
S
D
D50
NETWORK 4
SM400
MOV
En
D2003
S
D
D150
NETWORK 5
SM400
MOV
En
D2004
S
D
D230

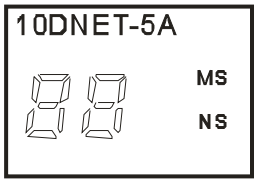


Note:

1. The above program is the ladder diagram program of AHCPU530-EN.
2. Controlling D1505~D1509 in AHCPU510-EN is equal to controlling D0, D30, D50, D150 and D230 in AHCPU530-EN.
3. Meanwhile, the current values in D0, D30, D50, D150 and D230 in AHCPU530-EN will be transmitted to D1005~D1009 in AHCPU510-EN in real time.

7.10 Error Diagnosis and Trouble Shooting

AH10DNET-5A provides three diagnosis methods such as indicator, seven-segment displayer and software diagnosis.



7.10.1 Indicator Diagnosis

- **NS LED**

LED status	Indication	How to deal with
OFF	No power; Duplicate ID detection has not completed.	1. Make sure that AH10DNET-5A is powered. 2. Ensure that at least one node or more are communicating on the network.
Green light blinking	No connection with the DeviceNet	No correction; Or refer to the code on the seven-segment displayer for the error-shooting.
Green light ON	Online and connecting with the DeviceNet normally	--
Red light blinking	Communication error.	Refer to the code on the seven-segment displayer for the error-shooting.
Red light ON	Network error: duplicate ID; no network power or bus-off	1. Make sure all the devices have their unique node address. 2. Check if the network installation is correct 3. Check if the node address of AH10DNET-5A is valid. 4. Check if the network power is normal.

- **MS LED**

LED status	Indication	How to deal with
OFF	No power	Make sure that AH10DNET-5A is powered and connected properly.
Green light blinking	The scanner module has not been configured	Configure the scan list and re-download the configuration to AH10DNET-5A.
Green light ON	Normally input/output data	--
Red light blinking	As the master, the slave in t he scan list of AH10DNET-5A works abnormally; as the slave, it is a configuration problem	Refer to the display on the seven-segment displayer and ensure that the slave message is consistent with that actually connected.
Red light ON	The internal error in AH10DNET-5A	1. Check if the configuration is correct 2. Repower it first and return it to the factory for repair if the error still exists.

- **NS and MS LED**

LED status		Indication	How to deal with
NS	**MS**		
OFF	**OFF**	No power	Check if the power of AH10DNET-5A is normal.

LED status		Indication	How to deal with
NS	MS		
OFF	Green light ON	Duplicate ID detection has not completed.	Ensure that at least one node on the network and AH10DNET-5A have the same baud rate and communicate normally.
Red light ON	Green light ON	Duplicate ID detection failed or bus-off.	1. Ensure that the node address of AH10DNET-5A is unique. 2. Repower it.
Red light ON	Red light blinking	No network power	1. Check if the network cable connection is correct. 2. Check if the network power is normal.
Red light ON	Red light ON	Hardware error	Return it to the factory for repair.

- **Seven-segment Displayer Diagnosis**

Code	Indication	How to deal with
0~63	Node address of DVPDNET-SL (in normal operation)	--
80	AH10DNET-5A is in STOP status.	Turn the AH500 series CPU module to RUN and start I/O data exchange.
F0	The node ID of AH10DNET-5A is repeated with that of other node or exceeds the valid range.	1. Ensure that the node address of AH10DNET-5A is unique. 2. Repower it after changing its node ID.
F1	No slave device in the scan list of AH10DNET-5A	Configure the scan list and download it to AH10DNET-5A.
F2	The work voltage of AH10DNET-5A is too low.	Check if the work power of AH10DNET-5A and the AH500 series CPU module is normal.
F3	Entering test mode	Switch IN1 from ON to OFF and re-power AH10DNET-5A.
F4	Bus-off	1. Check if the network cable is normal and the shielded wire has been grounded. 2. Check if the baud rate of the node equipment on the network is correct. 3. Check if the two ends of the network have been connected with 121 Ω resistor respectively. 4. Re-power AH10DNET-5A.
F5	No network power	Make sure the cable is correctly connected and check if the network power is normal.
F6	Internal error; internal storage detection error	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
F7	Data exchange unit error	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
F8	Sequence number detection error	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
F9	Error occurs when Reading/writing the configuration data.	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.

Code	Indication	How to deal with
FA	The node ID of AH10DNET-5A is repeated with that of the slave configured in the scan list.	Method 1: Set the node ID of AH10DNET-5A again, which must not be the same as that of the slave configured in the scan list and then repower it. Method 2: Do not make any slave configured to the scan list. Download the empty configuration to AH10DNET-5A by using the “Simulate online” function. Finally, repower it.
E0	AH10DNET-5A has detected that the node equipment on the bus is different from that in t he scan list.	1. Check if the slave address has been changed. 2. Check if the node equipment on the bus has been changed. 3. Configure the network again.
E1	The actual polled data length in slave is not consistent with that set in the scan list.	1.Check the actual IO data length of slave. (Please see step 4 in section 7.8.2.) 2.Configure relevant slaves to the scanner module again.
E2	Slave device in the scan list does not exist or is bus-off.	1. Check if the slave address has been changed. 2. Check if the network cable is connected normally in case it is loose or cut. 3. Check if the bus communication cable length exceeds the maximum transmission distance. If it does, the system will not be kept stable. (See section 7.3.3.)
E3	AH10DNET-5A fails to transmit a message.	1. Check if the connection between the scanner module and network is normal 2. Ensure that the baud rates of the scanner module and other node are the same.
E4	Error detected in sequence of fragmented I/O messages from slave device	Check if the slave is operating normally.
E5	Slave device returns error when AH10DNET-5A attempts to communicate with it.	Check if the slave is operating normally.
E6	The size of IO data returned from slave is bigger than that configured in the scan list.	Ensure that the IO data configuration length of slave and that in the scan list is the same.

Code	Indication	How to deal with
E7	AH10DNET-5A is checking if its station address is duplicate with that of other node equipment on the network	Please follow the methods below to shoot the troubles if the error code appears for long. 1. Ensure that at least two nodes work normally on the network. 2. Check if the two ends of the network are connected with 121 Ω terminal resistors respectively. 3. Ensure that the baud rates of all node equipment are the same. 4. Check if the network cable is connected normally in case it is loose or cut. 5. Check if the bus communication cable length exceeds the maximum transmission distance. If it does, the system can not be kept stable. 6. Check if the shielded wire in the network communication cable is grounded. 7. Repower AH10DNET-5A.
E8	AH10DNET-5A is initializing.	If initializing lasts too long, please repower AH10DNET-5A.

- **Software Diagnosis**

When ISPSoft is used to read PLC system record, the following error codes may appear.

Error code	Description	How to deal with
16#A080	In stop state	Turn the AH500 series CPU module to RUN through the RUN/STOP switch.
16#A0F1	No slave in the scan list	Configure the slave to the scan list and then download it to AH10DNET-5A.
16#A0E2	The slave configured in the scan list is bus-off or does not exist when AH10DNET-5A is in master mode.	1. Check if the slave address has been changed. 2. Check if the network cable is connected normally in case it is loose or cut. 3. Check whether the bus communication cable length exceeds the maximum transmission distance. If it does, the system will not be kept stable. (Please refer to section 7.3.3.)
	The connection between AH10DNET-5A (slave) and the master is interrupted when in slave mode.	

Error code	Description	How to deal with
16#A0E7	Checking if the node address of AH10DNET-5A is duplicate with that of other node equipment.	Please follow the methods below to shoot the troubles if the error code appears for long. 1. Ensure that at least two nodes work normally on the network. 2. Check if the two ends of the network are connected with 121 Ω terminal resistors respectively. 3. Ensure that the baud rates of all node equipment are the same. 4. Check if the network cable is connected normally in case it is loose or cut. 5. Check if the bus communication cable length exceeds the maximum transmission distance. If it does, the system can not be kept stable; 6. Check if the shielded wire in the network communication cable is grounded; 7. Repower AH10DNET-5A.
16#A0E8	AH10DNET-5A is initializing	If initializing lasts too long, please repower AH10DNET-5A.
16#A0F0	The node address of AH10DNET-5A is duplicate with that of other node or exceeds the valid range.	Ensure that the node address of AH10DNET-5A is unique and repower it after changing its node ID.
16#A0F2	The work voltage of AH10DNET-5A is too low.	Check if the work power of AH10DNET-5A and the AH500 series CPU module is normal.
16#A0F3	AH10DNET-5A enters the test mode.	Switch IN1 from ON to OFF and re-power AH10DNET-5A.
16#A0F4	AH10DNET-5A enters the bus-off state.	1. Check if the network cable is normal and the shielded wire has been grounded. 2. Check if the baud rates of all node equipment on the network are the same. 3. Check if the two ends of the network have been connected with 121 Ω resistor respectively. 4. Re-power AH10DNET-5A.
16#A0F5	No power for the DeviceNet network is detected.	Make sure that the cable is correctly connected and check if the network power is normal.
16#A0F6	Internal storage unit error in AH10DNET-5A	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
16#A0F7	Data exchange unit error in AH10DNET-5A	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
16#A0F8	Sequence number detection error in AH10DNET-5A	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.
16#A0F9	Error occurs when Reading/writing the configuration data	If the error still exists after re-power, send your AH10DNET-5A back to the factory for repair.

Error code	Description	How to deal with
16#A0FA	The node address of AH10DNET-5A is duplicate with that of the slave configured in the scan list.	Method 1: Set the node ID of AH10DNET-5A again, which must not be the same as that of the slave configured in the scan list and then re-power it. Method 2: Do not make any slave configured to the scan list. Download the empty configuration to AH10DNET-5A by using the “Simulate online” function. Finally, re-power it.

MEMO

Chapter 8 Network Module AH10SCM-5A

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8.1 Introduction

Thanks for using AH10SCM-5A, a serial communication module. To ensure that AH10SCM-5A is installed and operated correctly, please read this manual carefully before using the module. AHAH10SCM-5A is a serial communication module. It supports the Modbus UD Link (user-defined format). It can function as a BACnet MS/TP slave. A BACnet MS/TP master can read an analog value/binary value from AH10SCM-5A, and can write an analog value/binary value into AH10SCM-5A. Besides, it can be used as a RS-485/RS-422 communication port through which a program is downloaded to or uploaded from a CPU module. AH10SCM-5A is set by means of SCMSoft in DCISoft. Please use DCISoft version 1.08 or above.

Functions:

- It is equipped with two RS-485/RS-422 ports (COM1 & COM2)
- There is isolation between two parts of RS-485/RS-422 communication, and there is isolation between two parts of power.
- There are two built-in switches of 120 Ω terminal resistors.
- Every communication port can be connected to 32 devices at most.
- It can function as COM3 through which a program is downloaded or uploaded.
- Modbus Advance provides a means of exchanging data through Modbus.
- The UD Link provides a user-defined communication protocol, and a sequence-planning function.
- It can function as a BACnet MS/TP slave, and can be connected to a master.

The functional specifications

■ **RS-485/RS-422 communication interface**

Item	Specifications
Connector type	European-style terminal block
Transmission speed	1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 76,800, 115,200, 230,400, and 460,800 bps
Communication format	Stop bit: 1 bit and 2 bits Parity bit: none, an odd parity bit, and an even parity bit Data bit: 7 bits and 8 bits
Communication protocol	Modbus ASCII/RTU UD Link BACnet MS/TP slave stations

■ **Electrical specifications**

Item	Specifications
Supply voltage	5 V DC
Electric energy consumption	1.5 W
Insulation voltage	2,500 V DC
Weight	Approximately 131 g

■ **BACnet Protocol Implementation Statement**

◆ **Standard BACnet device**

Model	Device
AH10SCM-5A	BACnet Application Specific Controller (B-ASC)

◆ **BIBBs which are supported**

Model	BIBBs	BIBB
AH10SCM-5A	DS-RP-B	Data Sharing-ReadProperty-B
	DS-WP-B	Data Sharing-WriteProperty-B
	DM-DDB-B	Device Management-DynamicDeviceBinding-B
	DM-DOB-B	Device Management-DynamicObjectBinding-B
	DM-DCC-B	Device Management-DeviceCommunicationControl-B
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B
	DS-WPM-B	Data Sharing-WritePropertyMultiple-B

◆ **The objects which are supported**

Model	Object	Creation	Deletion
AH10SCM-5A	Analog Value	Not supported	Not supported
	Binary Value	Not supported	Not supported
	Device	Not supported	Not supported

◆ **Data Link Layer Options**

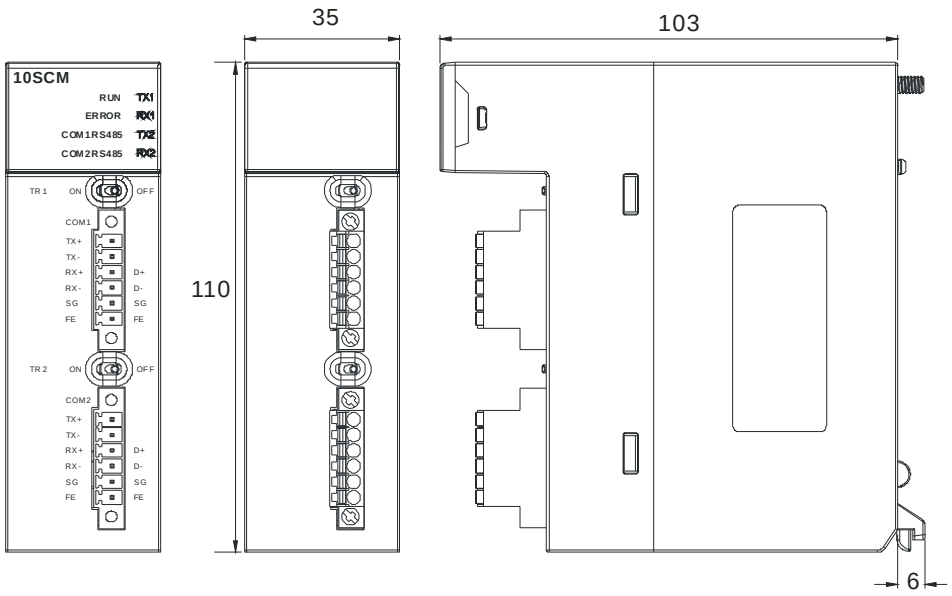
Model	Data link	Data transmission speed supported
AH10SCM-5A	MS/TP Slave	9600, 19200, 38400, and 76800 bps

◆ **Character set which is supported**

Model	Character set
AH10SCM-5A	ANSI X3.4

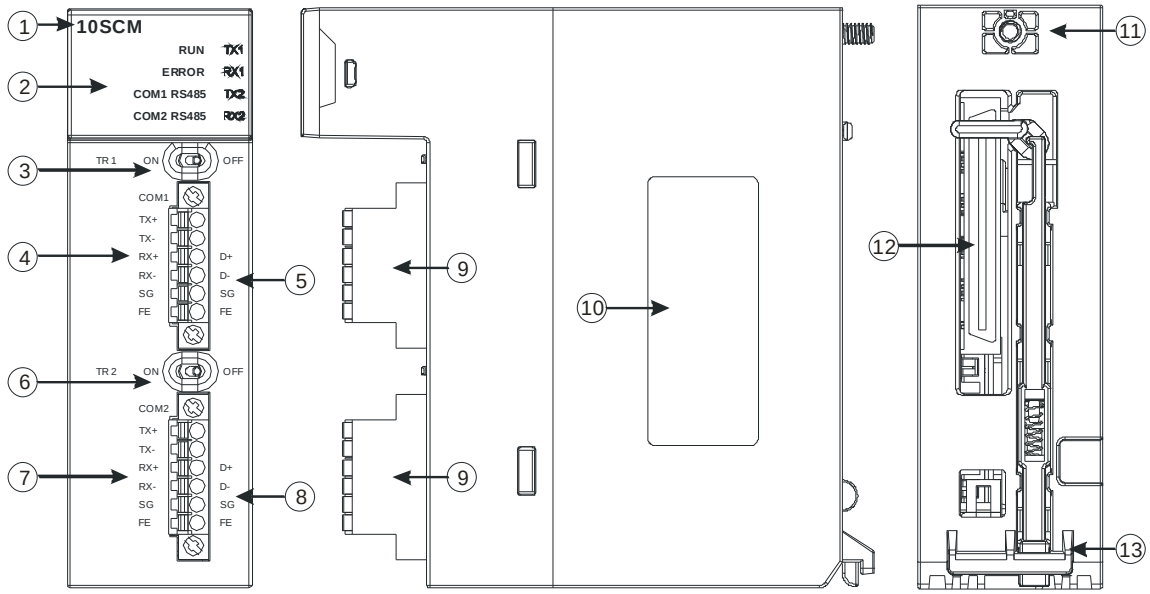
8.2 Dimensions and Profile

8.2.1 Dimensions



Unit: mm

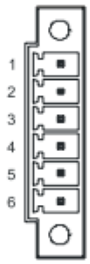
8.2.2 Profile



Number	Name	Description
1	Model name	Model name of the module
2	RUN LED indicator (green)	Operating status of the module ON: The module is running. OFF: The module stops running.
	ERROR LED indicator (red)	Error status of the module ON: There is a hardware error. OFF: The module is normal. Blink: 1. The setting of the module is incorrect, or there is a communication error. 2. Restoring the module to the default factory value
	COM1 (RS-485) LED indicator (green)	ON: RS-485 mode OFF: RS-422 mode
	COM2 (RS-485) LED indicator (green)	ON: RS-485 mode OFF: RS-422 mode
	TX1/TX2 LED indicator (orange)	Blink: The data is being transmitted through the RS-485/RS422 port. OFF: The data is not being transmitted through the RS-485/RS422 port.
	RX1/RX2 LED indicator (orange)	Blink: The data is being reveived through the RS-485/RS422 port. OFF: The data is not being reveived through the RS-485/RS422 port.
3	Switch of terminal resistor 1	Switching terminal resistor 1 ON/OFF
4	Terminals	Terminals for COM1 (RS-422)
5	Terminals	Terminals for COM1 (RS-485)
6	Switch of terminal resistor 2	Switching terminal resistor 2 ON/OFF
7	Terminals	Terminals for COM2 (RS-422)
8	Terminals	Terminals for COM2 (RS-485)
9	European-style terminal block	Terminals for wiring
10	Label	Nameplate

Number	Name	Description
11	Set screw	Fixing the module
12	Connector	Connecting the module and a backplane
13	Projection	Fixing the module

8.2.3 RS-485/RS-422 Communication Port

Terminal number	RS-485	RS-422	European-style terminal block
1	N/C	TX+	
2	N/C	TX-	
3	D+	RX+	
4	D-	RX-	
5	SG	SG	
6	FE	FE	

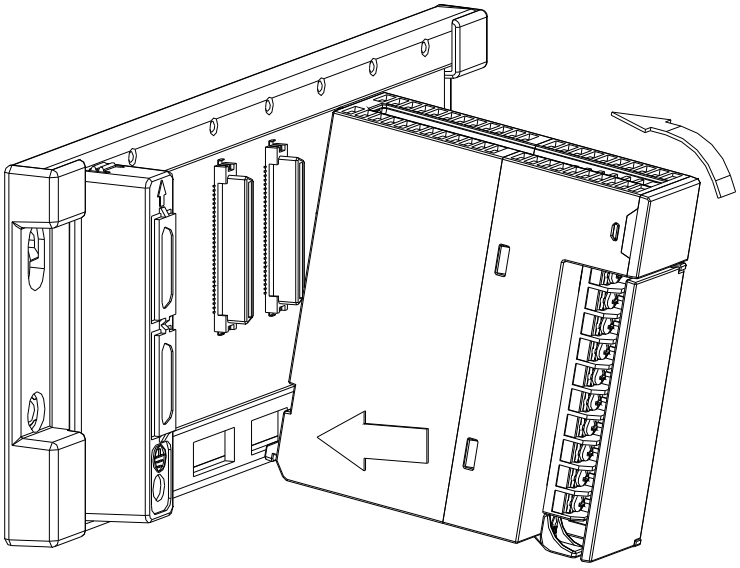
8.3 Installation and Wiring

This section introduces the installation of AH10SCM-5A.

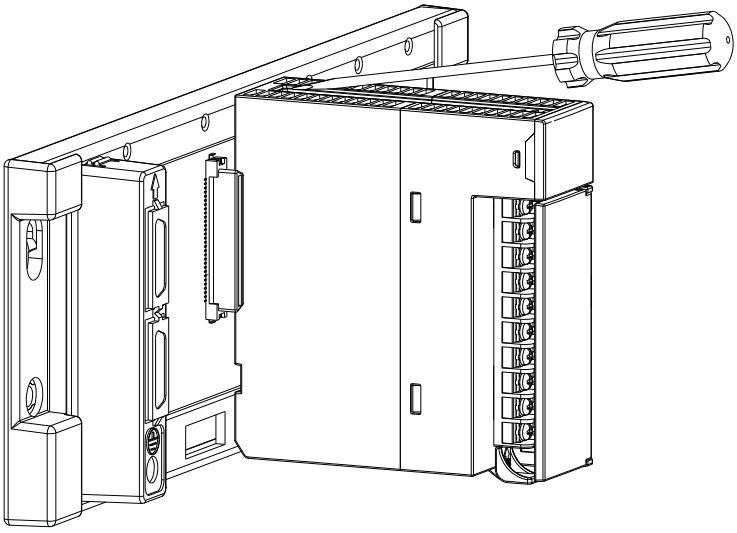
8.3.1 Installation

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.



3. Tighten the screw on the module.



8.4 Control Registers

CR#	Attribute	Register name	Description
0~6	Reserved		
7	R/W	Triggering the reading of data through COM1	High byte: Reading data from bit devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
8	R/W	Triggering the writing of data through COM1	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
9~16	Reserved		
17	R/W	Triggering the reading of data through COM2	High byte: Reading data from word devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
18	R/W	Triggering the writing of data through COM2	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
19	Reserved		
20	Reserved		
21	R/W	Triggering the sending/receiving of the packets in a group through COM1	Triggering the sending/receiving of the packets in a group through COM1

CR#	Attribute	Register name	Description
22	R/W	Base register used for the sending of data through COM1	The communication protocol for exchanging data through COM1 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** window in SCMSoft. Data register from which data is read=Value in CR#22+Offset
23	R/W	Base register used for the receiving of data through COM1	The communication protocol for exchanging data through COM1 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** window in SCMSoft. Data register into which data is written=Value in CR#23+Offset
24	Reserved		
25	R/W	Triggering the sending/receiving of the packets in a group through COM2	Triggering the sending/receiving of the packets in a group through COM2
26	R/W	Base register used for the sending of data through COM2	The communication protocol for exchanging data through COM2 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** window in SCMSoft. Data register from which data is read=Value in CR#26+Offset
27	R/W	Base register used for the receiving of data through COM2	The communication protocol for exchanging data through COM2 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** window in SCMSoft. Data register into which data is written=Value in CR#27+Offset
28	R/W	Triggering the sending/receiving of groups of packets in sequence	0: Not triggering it 1~254: Number of times the sending/receiving of groups of packets is triggered in sequence 255: The sending/receiving of groups of packets is continually triggered in sequence.
29~ 36863	Reserved		
36864	R/W	Status of sending a command through COM1	1: The sending of a command is executed. 0: The sending of a command is complete.
36865	R/W	Status of receiving a command through COM1	0: A command has not been received. 1: The receiving of a command is being processed. 2: A command is received successfully. 3: A command fails to be received. 4: Checksum error 5: Communication timeout
36866	R/W	Communication protocol for exchanging data through COM1	0: MODBUS 1: RS

CR#	Attribute	Register name	Description
36867	R/W	Sending/Receiving a command through COM1	0: After a command is sent, a command is received. 1: A command is sent, but no command is received. 2: No command is sent, but a command is received.
36868	R/W	Timeout period after which no data is received through COM1	0: No timeout 1~65535 ms
36869	R/W	Number of times the sending of a command through COM1 is retried	0~255
36870	R/W	Length of a packet which is sent through COM1	Length of a packet which is sent
36871	R/W	Length of a packet which is expected to be received through COM1	Length of a packet which is expected to be received
36872~37367	R/W	Contents of a packet sent through COM1	Contents of a packet which is sent
37368	R/W	Status of sending a command through COM2	1: The sending of a command is executed. 0: The sending of a command is complete.
37369	R/W	Status of receiving a command through COM2	0: A command has not been received. 1: The receiving of a command is being processed. 2: A command is received successfully. 3: A command fails to be received. 4: Checksum error 5: Communication timeout
37370	R/W	Communication protocol for exchanging data through COM2	0: MODBUS 1: RS
37871	R/W	Sending/Receiving a command through COM2	0: After a command is sent, a command is received. 1: A command is sent, but no command is received. 2: No command is sent, but a command is received.
37372	R/W	Timeout period after which no data is received through COM2	0: No timeout 1~65535 ms
37373	R/W	Number of times the sending of a command through COM2 is retried	0~255
37374	R/W	Length of a packet which is sent through COM2	Length of a packet which is sent
37375	R/W	Length of a packet which is expected to be received through COM2	Length of a packet which is expected to be received
37376~37871	R/W	Contents of a packet sent through COM2	Contents of a packet which is sent

8.4.1 Descriptions of the Control Registers

CR#7: Triggering the reading of data through COM1

[Description]
High byte: Reading data from bit devices; Low byte: Reading data from word devices
0: Not triggering it; 1: Triggering it once; 2: Always triggering it

After 1 or 2 is written into CR#7, the reading of data through COM1 will be triggered. After 0 is written into CR#7, the reading of data through COM1 will stop.

		COM1 Word		
		Not triggering it	**Triggering it once**	**Always triggering it**
COM1 Bit	**Not triggering it**	16#0000	16#0001	16#0002
	Triggering it once	16#0100	16#0101	16#0102
	Always triggering it	16#0200	16#0201	16#0202

CR#8: Triggering the writing of data through COM1

[Description]
High byte: Writing data into bit devices; Low byte: Writing data into word devices
0: Not triggering it; 1: Triggering it once; 2: Always triggering it
After 1 or 2 is written into CR#8, the writing of data through COM1 will be triggered. After 0 is written into CR#8, the writing of data through COM1 will stop.
Please refer to the table in the description of CR#7.

CR#17: Triggering the reading of data through COM2

[Description]
High byte: Reading data from bit devices; Low byte: Reading data from word devices
0: Not triggering it; 1: Triggering it once; 2: Always triggering it
After 1 or 2 is written into CR#17, the reading of data through COM2 will be triggered. After 0 is written into CR#17, the reading of data through COM2 will stop.
Please refer to the table in the description of CR#7.

CR#18: Triggering the writing of data through COM2

[Description]
High byte: Bit; Low byte: Word
0: Not triggering it; 1: Triggering it once; 2: Always triggering it
Please refer to the table in the description of CR#7.

CR#21: Triggering the sending/receiving of the packets in a group through COM1

[Description]
After a group number is written into CR#21, the packets in a group will be sent/received through COM1.
After 1 is written in CR#21, the sending/receiving of the packets in group 1 will be triggered. After the sending/receiving of the packets in group 1 is triggered, the value in CR#21 will become 0.
Default: 0 (Not triggering the sending/receiving of the packets in any group.)

CR#22: Base register used for the sending of data through COM1

[Description]
The communication protocol for exchanging data through COM1 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** widow in SCMSoft.
Data register from which data is read=Value in CR#22+Offset
Example:
The value in CR#22 is 1.→D1
Base+Offset in the **Mapping Register** box in the **Message Variable Edit** widow in SCMSoft is selected. The offset is 10, and the length is 2.→(R (Base+Offset [10]), 2)
D (1+10)→Two-byte data is read from D11.

CR#23: Base register used in the receiving of data through COM2

[Description]
The communication protocol for exchanging data through COM1 must be UD Link. Users have to select **Base+Offset** in the **Mapping Register** box in the **Message Variable Edit** widow in SCMSoft.
Data register into which data is written=Value in CR#23+Offset

CR#25: Triggering the sending/receiving of the packets in a group through COM2

[Description]
Please refer to the description of CR#21.

CR#26: Base register used for the sending of data through COM2

[Description]
Please refer to the description of CR#22.

CR#27: Base register used for the receiving of data through COM2

[Description]
Please refer to the description of CR#23.

CR#28: Triggering the sending/receiving of groups of packets in sequence

[Description]
High byte: COM1; Low byte: COM2
The number of times the sending/receiving of groups of packets is triggered in sequence is written into CR#28. If the value in CR#28 is 0, the sending/receiving of groups of packets is not triggered. The number of times the sending/receiving of groups of packets is triggered in sequence is in the range of 1 to 254. If the value in CR#28 is 255 (16#FF), the sending/receiving of groups of packets is continually triggered in sequence.

CR#36864: Status of sending a command through COM1

[Description]
A command is sent from AH10SCM-5A.
1: The sending of a command is executed.
0: The sending of a command is complete.

CR#36865: Status of receiving a command through COM1

[Description]
0: A command has not been received.
1: The receiving of a command is being processed.
2: A command is received successfully.
3: A command fails to be received.
4: Checksum error
5: Communication timeout

CR#36866: Communication protocol for exchanging data through COM1

[Description]
0: Modbus
1: RS

CR#36867: Sending/Receiving a command through COM1

[Description]
0: After a command is sent, a command is received.
1: A command is sent, but no command is received.
2: No command is sent, but a command is received.

CR#36868: Timeout period after which no data is received through COM1

[Description]
0~65535 ms

CR#36869: Number of times the sending of a command through COM1 is retried

[Description]
If communication fails, the sending of a command can be retried.
The number of times the sending of a command through COM1 is retried is in the range of 0 to 255.

CR#36870: Length of a packet which is sent through COM1 (Unit: Byte)

[Description]
0~900 bytes

CR#36871: Length of a packet which is expected to be received through COM1 (Unit: Byte)

[Description]
0~900 bytes

CR#36872~37367: Contents of a packet sent through COM1

[Description]
A packet which users want to send

CR#37368: Status of sending a command through COM2

[Description]
Please refer to the description of CR#36864.

CR#37369: Status of receiving a command through COM2

[Description]
Please refer to the description of CR#36865.

CR#37370: Communication protocol for exchanging data through COM2

[Description]
Please refer to the description of CR#36866.

CR#37371: Sending/Receiving a command through COM2

[Description]
Please refer to the description of CR#36867.

CR#37372: Timeout period after which no data is received through COM2

[Description]
Please refer to the description of CR#36868.

CR37373#: Number of times the sending of a command through COM2 is retried

[Description]
Please refer to the description of CR#36869.

CR#37374: Length of a packet which is sent through COM2 (Unit: Byte)

[Description]
Please refer to the description of CR#36870.

CR#37375: Length of a packet which is expected to be received through COM2 (Unit: Byte)

[Description]
Please refer to the description of CR#36871.

CR#37376~37871: Contents of a packet sent through COM2

[Description]
Please refer to the description of CR#36372~37367.

8.4.2 Introduction of the Related Instructions

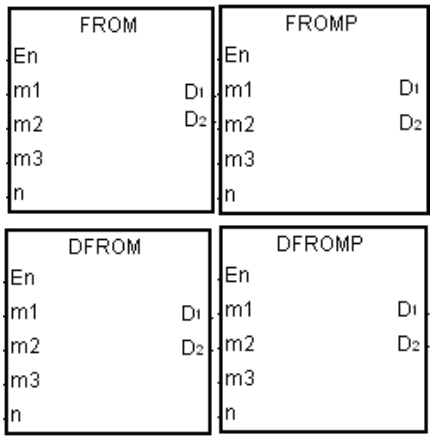
After AH10SCM-5A is installed, users need to write a program to control the related functions of AH10SCM-5A. The users can read data from a control register in AH10SCM-5A by means of the instruction FROM, and write data into a control register AH10SCM-5A by means of the instruction TO.

API	Instruction code			Operand	Function
1400	D	FROM	P	$m_1, m_2, m_3, D_1, D_2, n$	Reading the data from the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m_1	●	●			●	●	●	●	●				●	○	○		
m_2	●	●			●	●	●	●	●				●	○	○		
m_3	●	●			●	●	●	●	●				●	○	○		
D_1	●	●			●	●	●	●	●				●				
D_2	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:



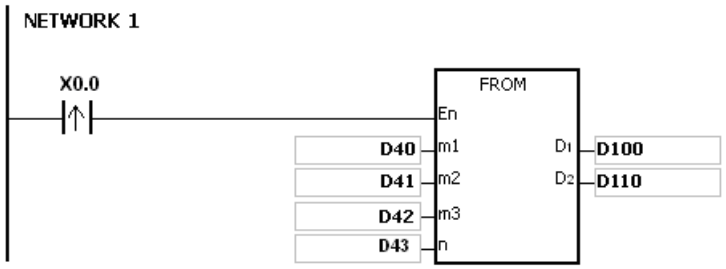
m_1	:	Rack code	Word/Double word
m_2	:	Slot code	Word/Double word
m_3	:	Control register number	Word/Double word
D_1	:	Device in which the data is stored	Word/Double word
D_2	:	Device in which the error code is stored	Word/Double word
n	:	Data length	Word/Double word

Explanation:

1. Users can use this instruction to read the data from the control register in the special module into the AH500 series PLC.
2. The operand m_1 should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand m_2 should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
4. The operand m_3 specifies the control register number.
5. When the instruction FROM is executed, D_2 is set to 0. When an error occurs, D_2 is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be in the range of 1 to 256, and the operand **n** used in the 32-bit instruction should be in the range of 1 to 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. Please refer to the regulation of the operands in the instruction TO for more information about the numbering of the special modules.

Example:

Suppose the first special module at the right side of the CPU module is AH10SCM-5A. When X0.0 is switched from OFF to ON, the instruction FROM is executed. The mode of the data exchange through COM1 on AH10SCM-5A stored in CR#7 is read into D100. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.



The use of the parameters:

- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The mode of the data exchange through COM1 is stored in CR#7. Therefore, the control register number stored in D42 is 16#0007.
- Owing to the fact that the mode of the data exchange through COM1 occupies one register, the value in D43 is 1.
- The data which is read from CR#7 is stored in D100.

Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{D_1}$~$\mathbf{D_1}$+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction FROM decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

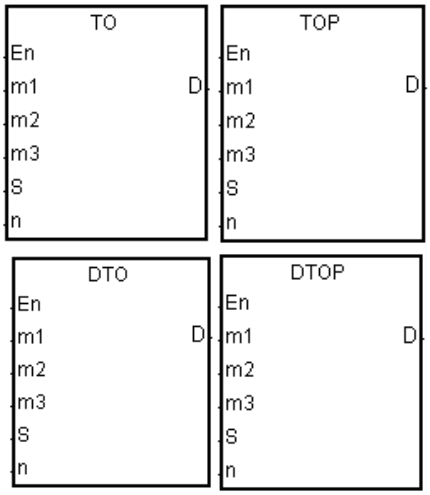
Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

API	Instruction code			Operand	Function
1401	D	TO	P	m_1, m_2, m_3, S, D, n	Writing the data into the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m_1	●	●			●	●	●	●	●				●	○	○		
m_2	●	●			●	●	●	●	●				●	○	○		
m_3	●	●			●	●	●	●	●				●	○	○		
S	●	●			●	●	●	●	●				●	○	○		
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:



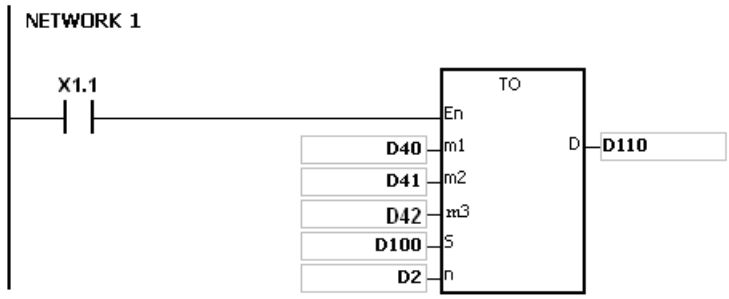
m_1	:	Rack code	Word/Double word
m_2	:	Slot code	Word/Double word
m_3	:	Control register number	Word/Double word
S	:	Data which is written into the control register	Word/Double word
D	:	Device in which the error code is stored	Word/Double word
n	:	Data length	Word/Double word

Explanation:

1. Users can use this instruction to write the data in the AH500 series PLC into the control register in the special module.
2. The operand m_1 should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand m_2 should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
4. The operand m_3 specifies the control register number.
5. When the instruction TO is executed, **D** is set to 0. When an error occurs, **D** is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be in the range of 1 to 256, and the operand **n** used in the 32-bit instruction should be in the range of 1 to 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. When **S** is a decimal value or a hexadecimal value, **n** decimal values or **n** hexadecimal values are transmitted to the I/O module. Suppose **S** is 16#0001 and **n** is 3. Three 16#0001s are transmitted to the I/O module.

Example:

Suppose the first special module at the right side of the CPU module is AH10SCM-5A. When X1.1 is switched from OFF to ON, the instruction TO is executed. The mode of the data exchange through COM1 on AH10SCM-5A stored in CR#7 changes from being disabled to being enabled. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.

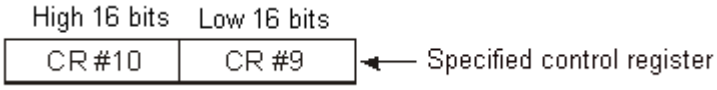


The use of the parameters:

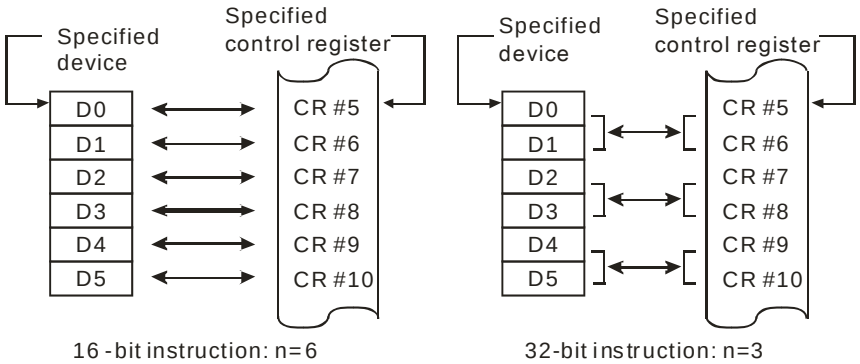
- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The mode of the data exchange through COM1 is stored in CR#7. Therefore, the control register number stored in D42 is 16#0007.
- Owing to the fact that the mode of the data exchange through COM1 occupies one register, the value in D2 is 1.
- The data which is written into CR#7 is stored in D100. Therefore, the value in D100 is 16#0002.

The regulation of the operands in the instruction:

- The operand $\mathbf{m_1}$ specifies the rack code. It should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
- The operand $\mathbf{m_2}$ specifies the slot code. It should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
- The operand $\mathbf{m_3}$ specifies the control register number. The 16-bit memories built in the special modules are called the control registers. The control register numbers are decimal numbers #0~#N, and the number of control registers varies with the module. The operating conditions of the special module and the setting values are stored in the control registers.
- At most 68 special modules can be placed on the rack, and they do not occupy inputs/outputs.
- If the instruction FROM/TO is used, one control register is taken as a unit for the reading/writing of the data. If the instruction DFROM/DTO is used, two control registers are taken as a unit for the reading/writing of the data.



- The **n** which is 2 in the 16-bit instruction has the same meaning as the **n** which is 1 in the 32-bit instruction.



Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**~**S**+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error

code in SR0 is 16#2003.

3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction TO decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

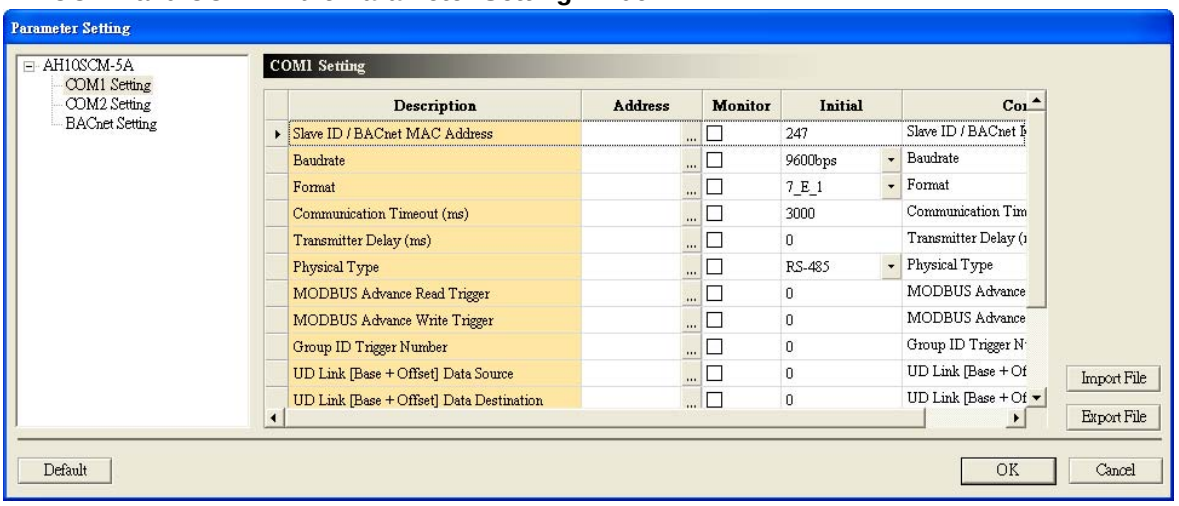
Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

8.5 Quick Start

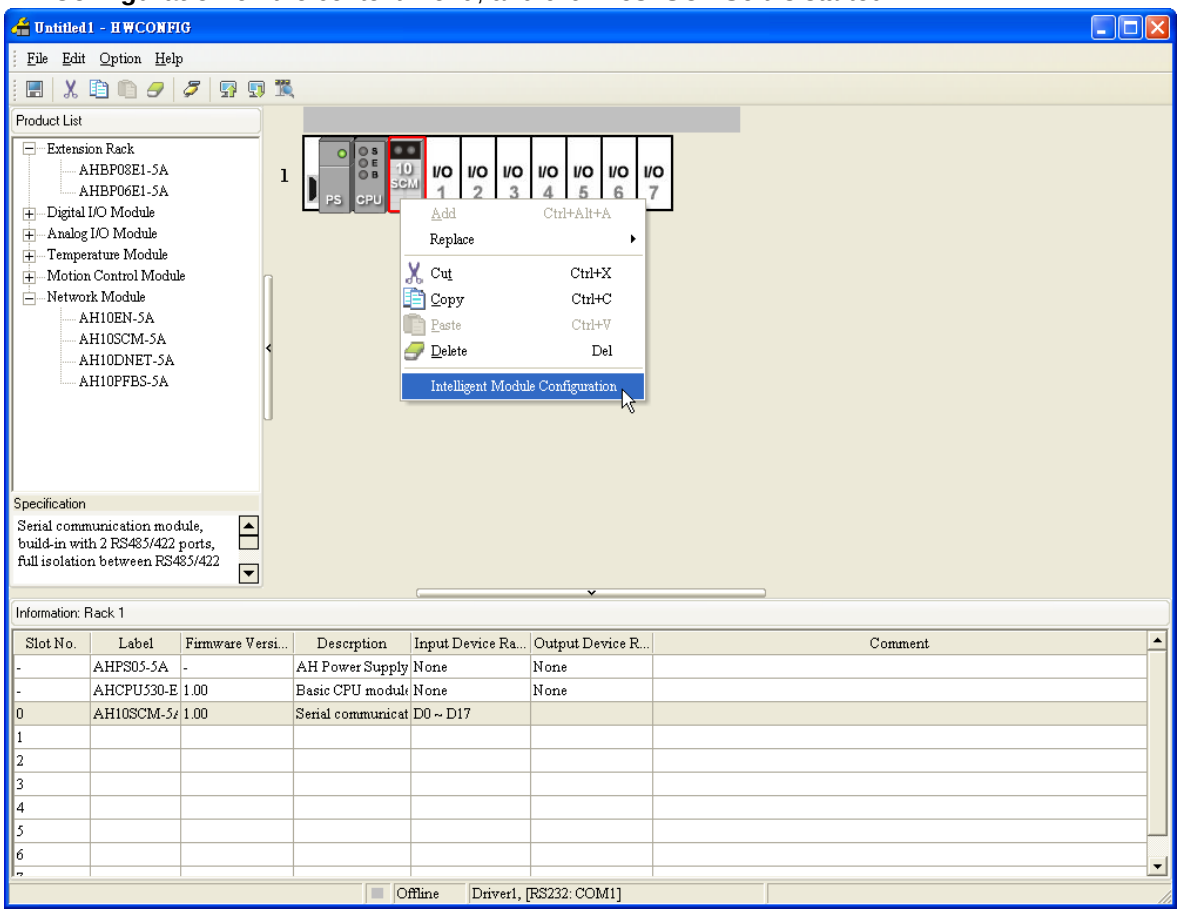
This section introduces how to carry out the Modbus RS-485/RS-422 communication through a communication port on AH10SCN-5A.

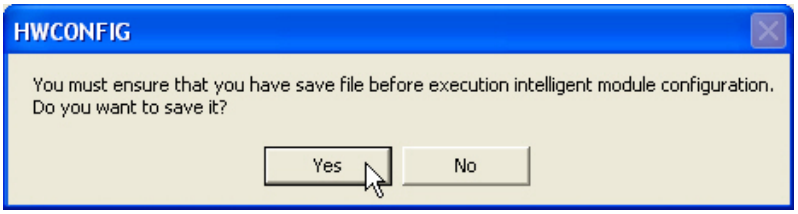
- **Setting communication**

  After users double-click the module AH10SCM-5A in the **HWCONFIG** window, they can set COM1 and COM2 in the **Parameter Setting** window



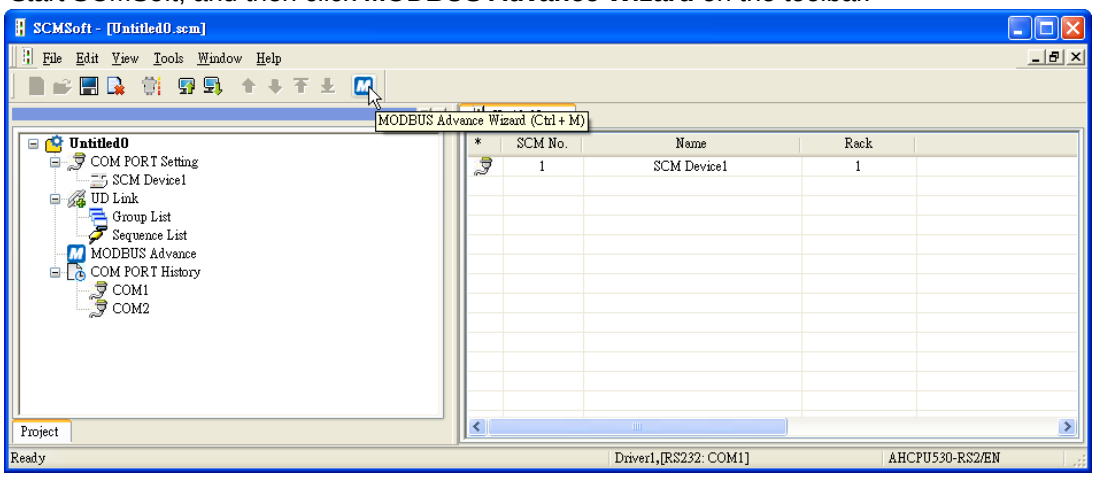
Start ISPSoft, right-click the module in the **HWCONFIG** window, click **Intelligent Module Configuration** on the context menu, and click **Yes**. SCMSoft is started.

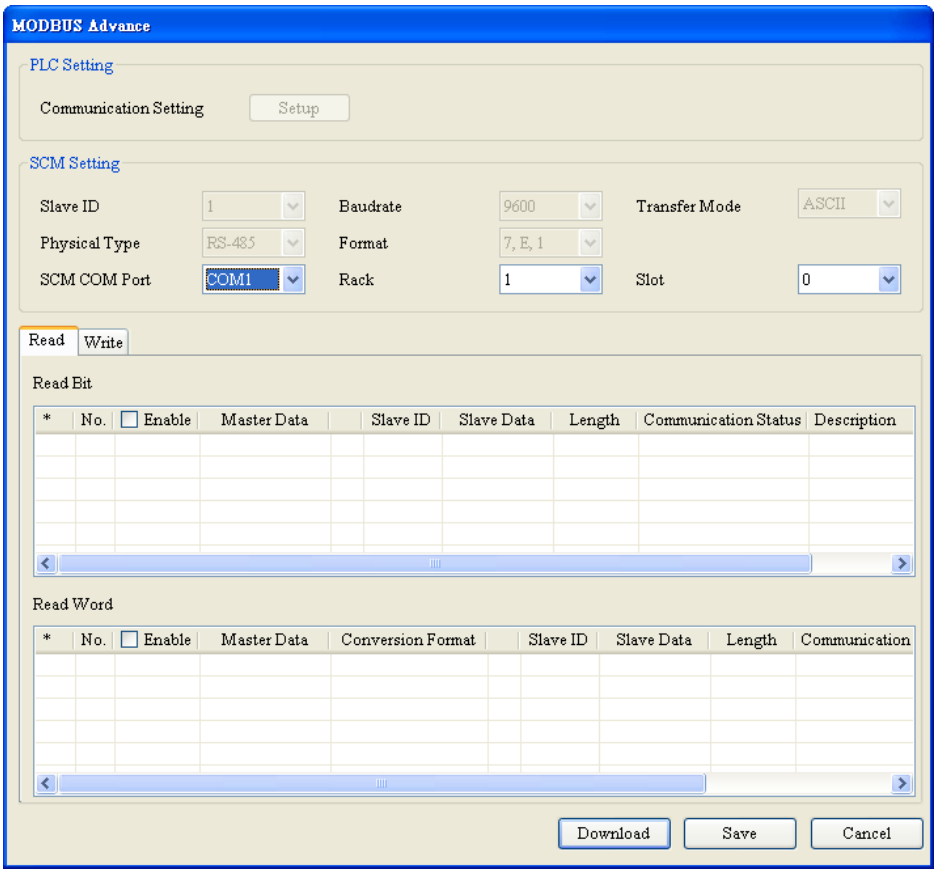



HWCONFIG
You must ensure that you have save file before execution intelligent module configuration.
Do you want to save it?
Yes
No

- **Modbus Advance**

  Start SCMSoft, and then click **MODBUS Advance Wizard** on the toolbar.





- **Setting Modbus Advance**

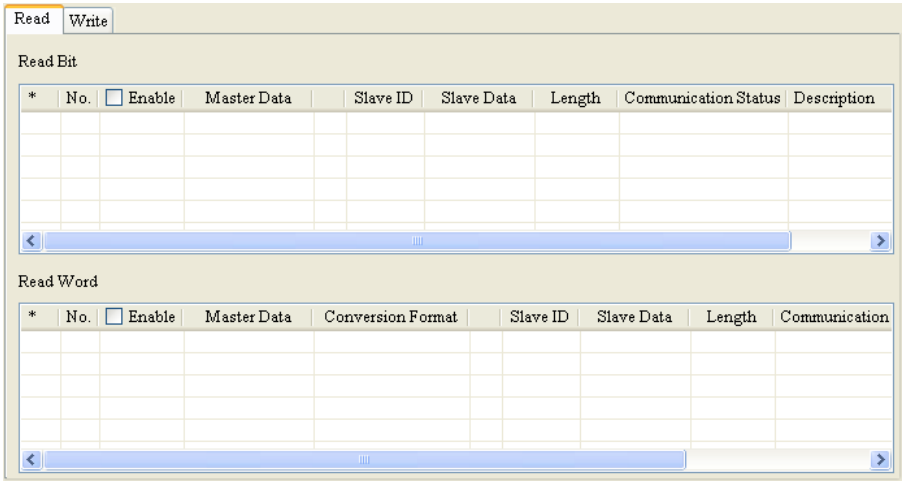
  To speed up standard Modbus communication, SCMSoft provides the Modbus Advance wizard. Users only need to specify registers or absolute positions from which data is read, specify registers or absolute positions into which data is written, select a communication port, and download the setting to AH10SCM-5A. After flags are enabled, the reading of the data, and the writing of the data are complete. The steps of setting the wizard are as follows.

  (1) SCM setting

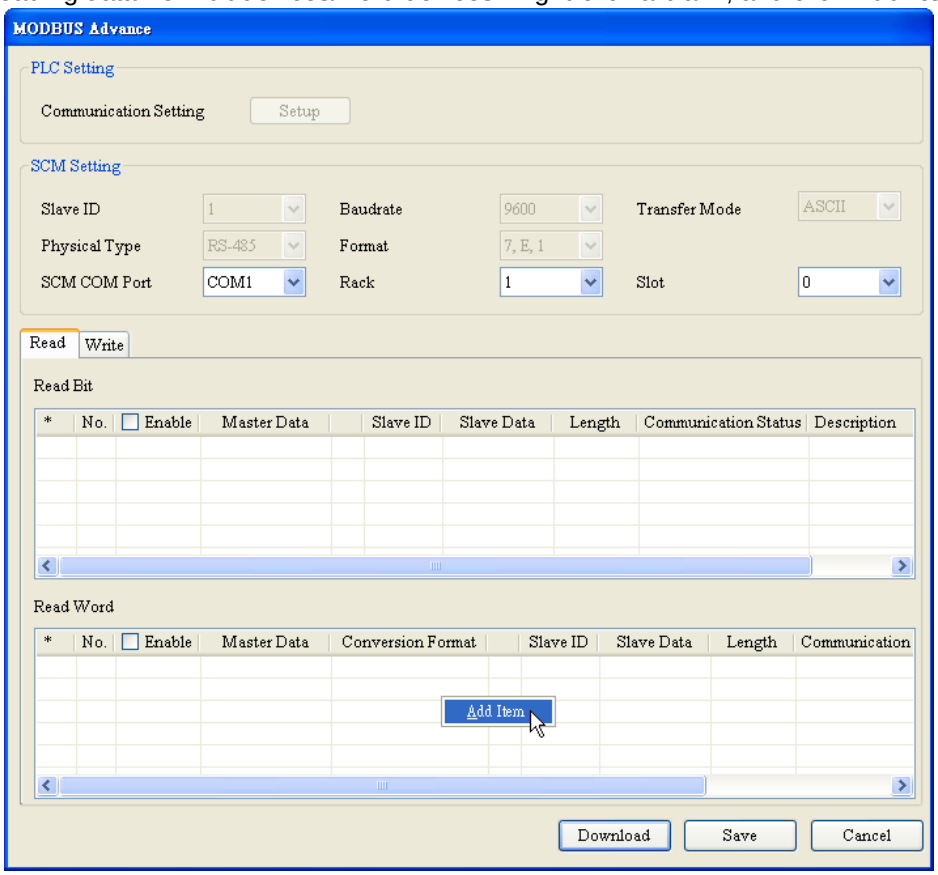
  Users can specify a backplane, a slot, and a communication port. Besides, they can set a slave ID, a transmission speed, a communication interface, a transmission mode, and a format.

  (2) Modbus Advance─Reading and writing

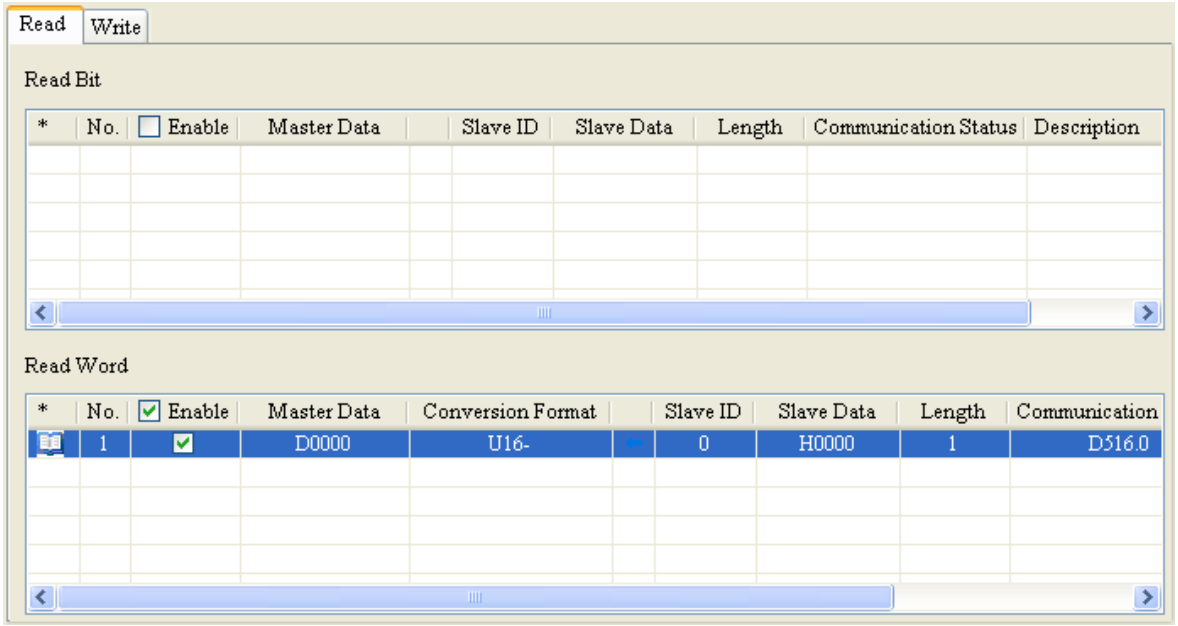
  Reading data from bit devices/word devices, and writing data into bit devices/word devices

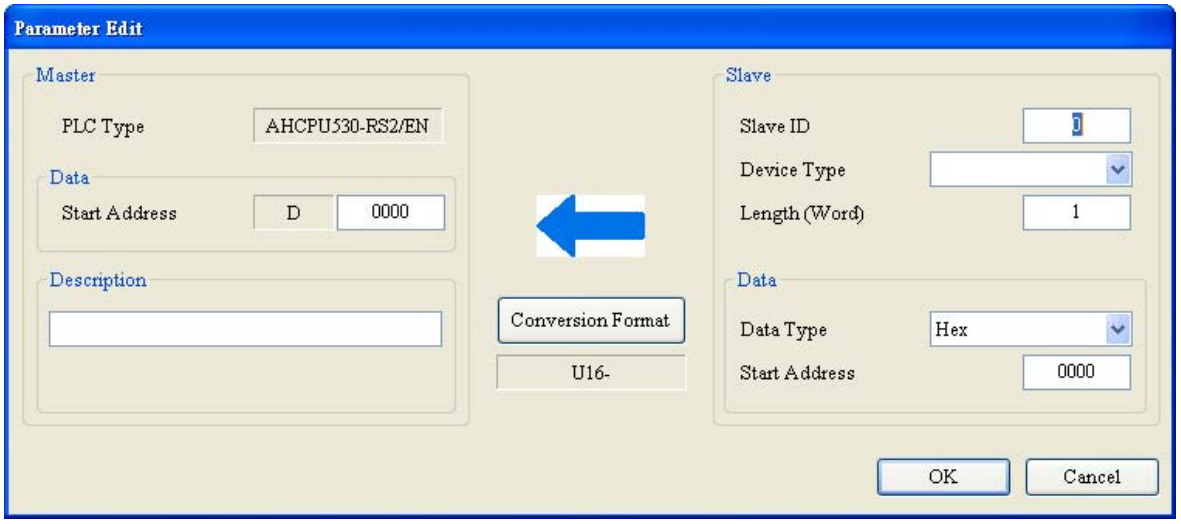

Read
Write
Read Bit
* No. Enable Master Data Slave ID Slave Data Length Communication Status Description
Read Word
* No. Enable Master Data Conversion Format Slave ID Slave Data Length Communication

Reading data from bit devices/word devices: Right-click a blank, and click **Add Item**.



After users double-click the item which is added, the **Parameter Edit** window appears.


Read
Write
Read Bit
* No. Enable Master Data Slave ID Slave Data Length Communication Status Description
Read Word
* No. Enable Master Data Conversion Format Slave ID Slave Data Length Communication
1 D0000 U16- 0 H0000 1 D516.0



Master:

PLC type: A default PLC type is displayed. Users can change the PLC type by means of clicking **Change PLC Type** on the **Tools** menu in SCMSoft.

Data: Users can set an initial data register into which data is written.

Description: Users can enter a description of a device into which data is written. (Length: 30 bytes at most)

Slave:

Slave ID: A slave from which data is read

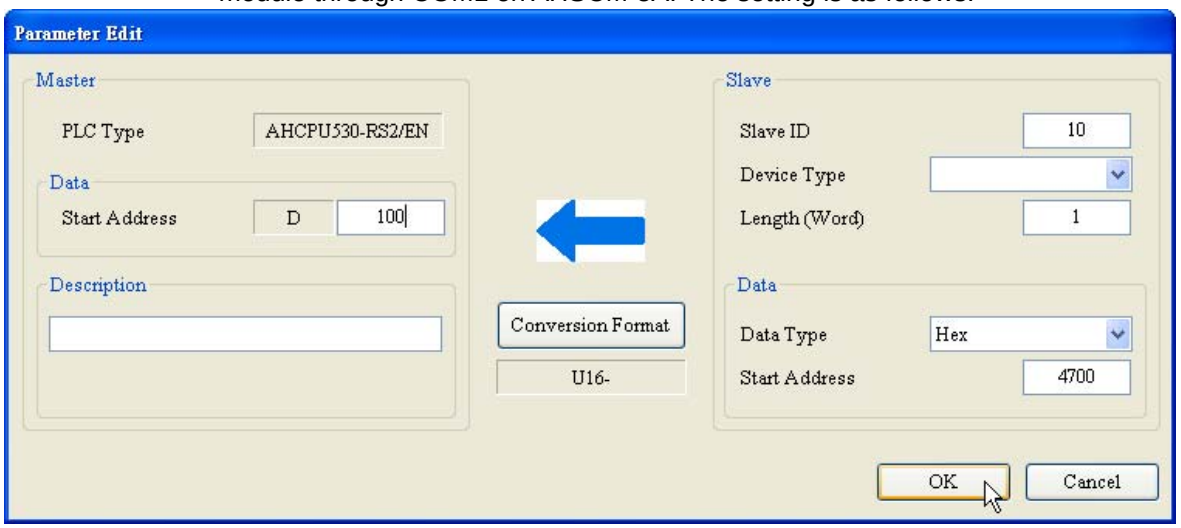
Device type: Users can select a Delta PLC. Leave the **Device Type** box blank if a device used is not a Delta PLC.

Length: The length of data read is 100 words at most.

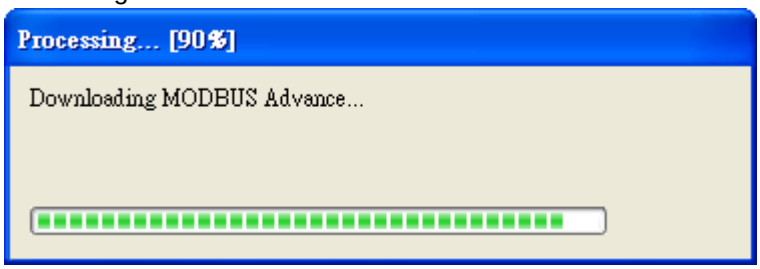
Data type: Users can select **Hex** or **Modbus 6 digit**. If **Hex** is selected, a data type is represented by a four-digit hexadecimal value. If **Modbus 6 digit** is selected, a data type is represented by a six-digit decimal value. If a device used is a Delta PLC, **D** automatically appears in the **Data Type** box.

Start address: Users can set an initial register from which data is read

Example: There is a present value stored in 16#4700 in a Delta DTA series temperature controller. The slave ID is 10. The present value can be read into D100 in a CPU module through COM1 on AHSCM-5A. The setting is as follows.



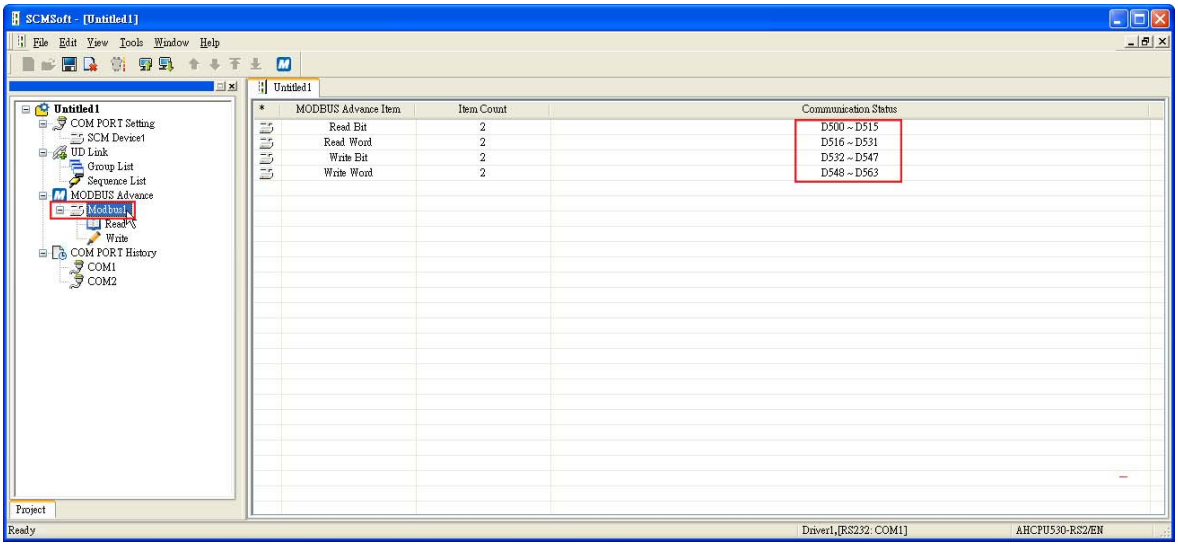
- **Downloading the parameters**
  After the setting is complete, check whether the setting of other parameters conforms to the setting of the slave. Click **Download**.



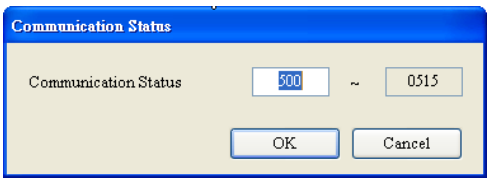
- **Communication status**
  AH10SCM-5A provides the status of Modbus communication. Data exchanges include reading data from bit devices/word devices, and writing data into bit devices/word devices. The status of executing a data exchange is represented by the state of a bit in a data register. For example, if D100 is an initial register in which the states of the bits represent the statuses of data exchanges, the status of exchanging data 1 is represented by the state of bit0 in D100, and the status of exchanging data 2 is represented by the state of bit1 in D100, and so on.

Dn																
Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

D (n+1)																
Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17



The TCP keepalive period by default is set to 30 seconds. D500 is an initial register in which statuses of data exchanges are stored. Users can enter **MODBUS Advance** to alter the initial register.

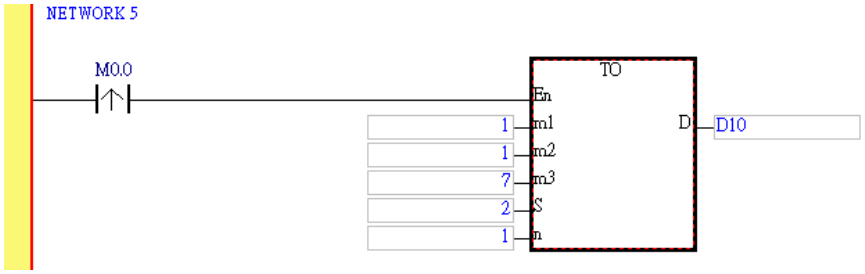


- **Triggering the reading/writing of data**

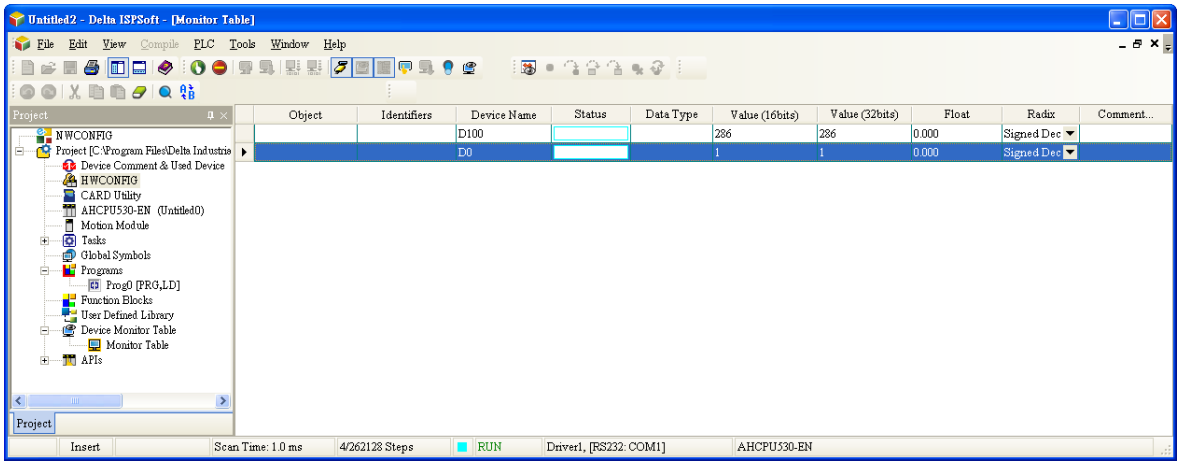
  Users can use the instruction TO in ISPSoft to trigger the reading of data from bit devices/word devices, and the writing of data into bit devices/word devices. (CR#7, CR#8, CR#17, and CR#18)

CR#	Attribute	Register name	Description
7	R/W	Triggering the reading of data through COM1	High byte: Reading data from bit devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
17	R/W	Triggering the reading of data through COM2	High byte: Reading data from bit devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
8	R/W	Triggering the writing of data through COM1	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
18	R/W	Triggering the writing of data through COM2	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it

If users want to continually trigger the reading of data from word devices, they can write 2 into CR#7. If users wan to trigger the reading of data from word devices once, they can write 1 into CR#7.



After M0 is triggered, a present value can be read into D100 in a CPU module through COM1 on AHSCM-5A. The value of bit0 in D0 is 1.



8.6 Software

This section introduces SCMSoft, which is used to set AH10SCM-5A.

8.6.1 SCM Project

Users can make an SCM project for COM1 and COM2 on AH10SCM-5A. An SCM project is composed of four parts.

COM Port setting: Users can set communication protocols for exchanging data through COM1 and COM2. (See section 8.6.2.)

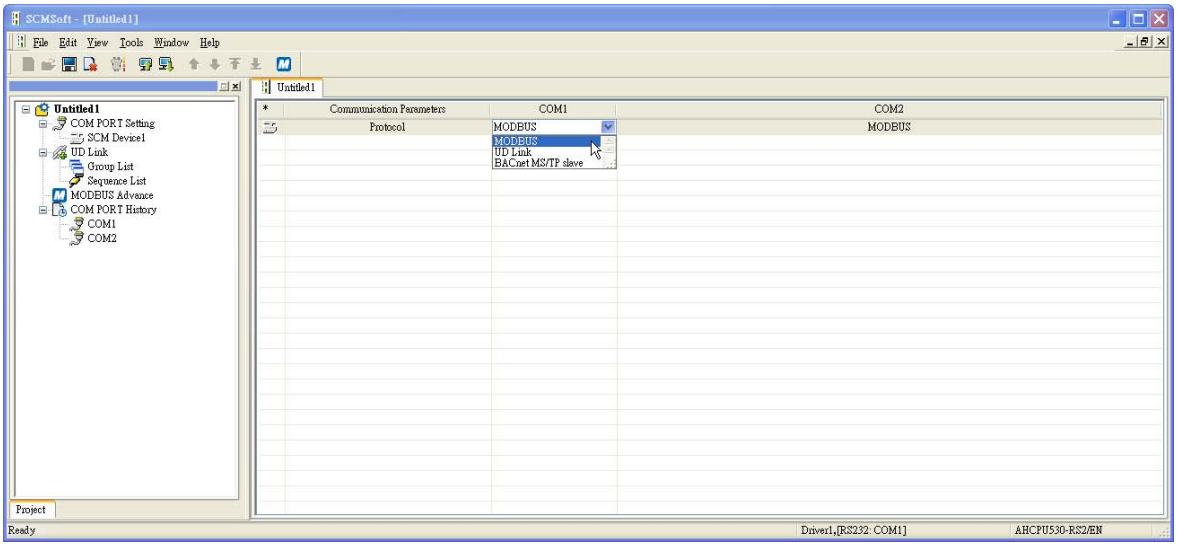
UD Link: RS-485/RS-422 communication can be used. Users can define the contents of a packet by themselves. (See section 8.6.3.)

Modbus Advance: A standard Modbus RS-485/RS-422 device can use this function. Other Delta automation products and other standard Modbus communication devices can also use this function. (See section 8.6.4.)

COM port history: The communication history of AH10SCM-5A can be recorded. (See section 8.6.5.)

8.6.2 COM Port Setting

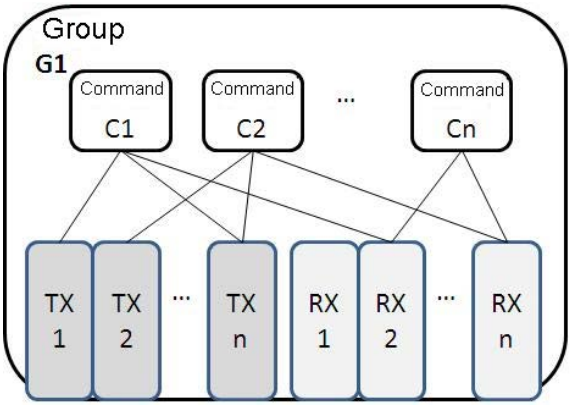
Setting a communication protocol: Modbus, UD Link (user-defined RS-485/RS-422 format), and BACnet MS/TP slave



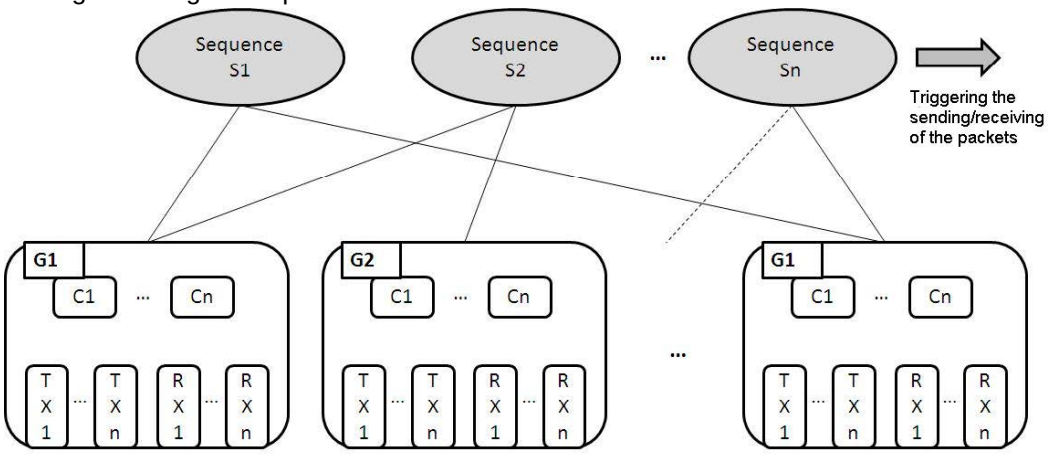
8.6.3 UD Link (User-defined Communication)

The UD Link provides non-Modbus RS-485/RS-422 communication. A packet can be edited according to a communication format. The steps of creating an UD Link are as follows.

(1) Creating a group→Editing TX packets and RX packets→Creating commands→Downloading the group, and then triggering the sending/receiving of the packets



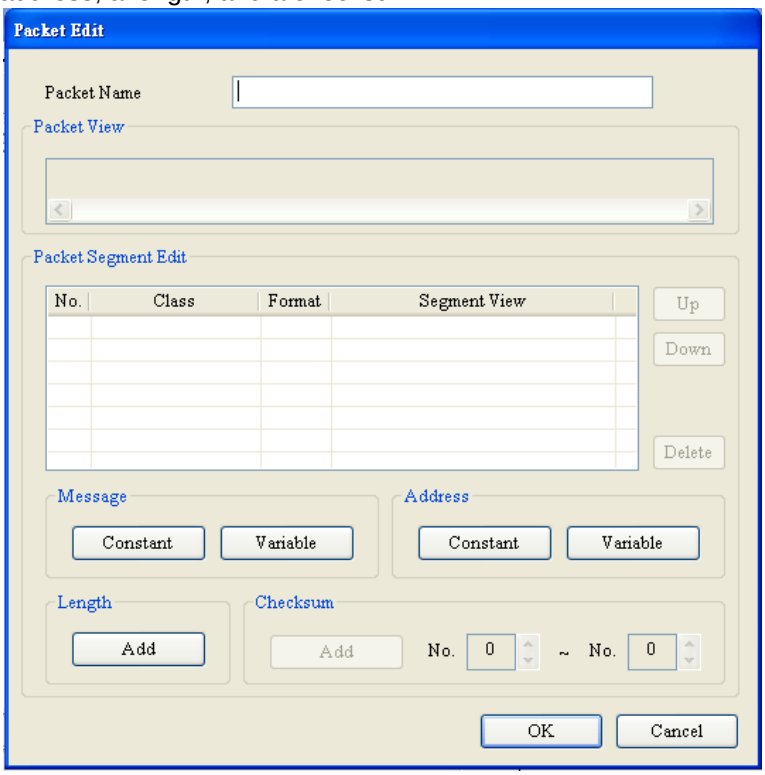
(2) Creating a group→Editing TX packets and RX packets→Creating commands→Creating other groups→Creating sequences→Downloading the sequences, and then triggering the sending/receiving of the packets



First, create TX packets and RX packets in a group. Then, set the sequence of sending/receiving the packets, and the number of times the packets are sent/received through commands. Finally, the sending/receiving of the packets in the group is triggered. Besides, if several different types of packets are required in a larger system, users can arrange several groups in sequence, and set the sequence of sending/receiving the packets in the groups.

8.6.3.1 TX Packets and RX Packets

Several TX packets and RX packets can be created in a group. A TX packet/RX packet is composed of messages, an address, a length, and a checksum.



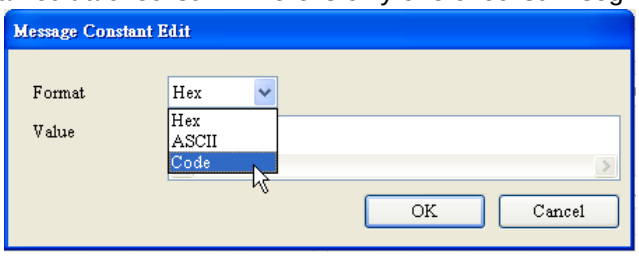
- Packet name: Users can edit a packet name.
- Packet view: The contents of a packet are displayed.
- Packet segment edit: Users can adjust the sequence of segments, and add/delete segments.
  No.: A segment number is displayed. Users can edit 64 segments at most.
  Class: A segment class is displayed. A message, an address, a length, and a checksum are

classes.

Format: The data format of a segment is displayed. A hexadecimal value, an ASCII code, and a code are data formats.

Segment view: The contents of a segment are displayed.

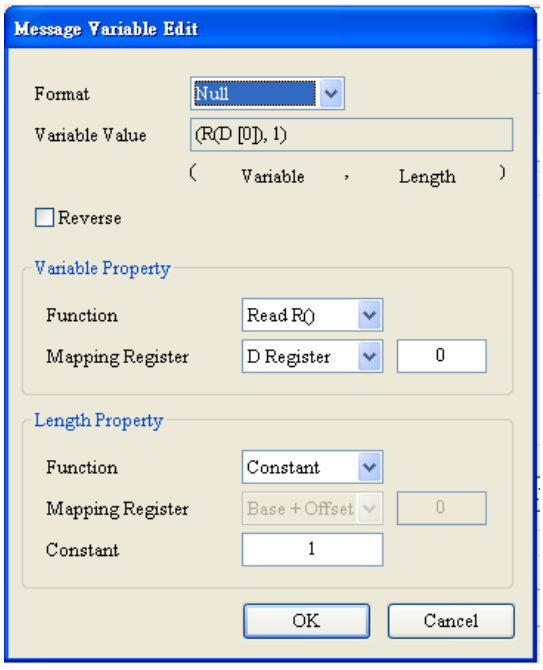
- Message: Users can edit “constant” messages and “variable” messages. Messages can be applied to a header segment, a start bit segment, an end bit segment, and a data segment. There can be several messages in a packet.
- Address: Users can edit a “constant” address, and a “variable” address. There is only one address segment in a packet.
- Length: Users can edit the length of a packet. There is only one length segment in a packet.
- Checksum: Users can edit a checksum. There is only one checksum segment in a packet.



- Constant: Data is a constant.

  Format: Users can select **Hex**, **ASCII**, or **Code** in the **Format** box. If **Code** is selected, data used is a control code.

  Value: User can enter a constant.



- Variable: Data is a variable. Users can specify an internal register in AH10SCM-5A, or a register in a CPU module.
- Format: Users can set the format of data

  Null: Data is not processed.

  Hex: ASCII data is converted into hexadecimal data. ASCII data which can not be converted into hexadecimal data will be converted into 0.

  ASCII: Hexadecimal data is converted into ASCII data. Hexadecimal data which can not be converted into ASCII data will be converted into 0.
- Variable property

  Function: For a TX packet, users can select Read R () in the **Functio**n box. For a RX packet, the users can select **Read R ()**, **Write W ()**, or ***** in the **Function** box.

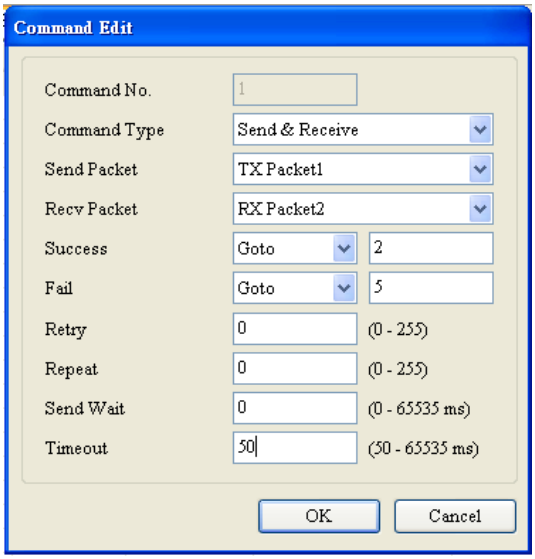
Mapping register: Users can select an internal register in AH10SCM-5A, or a register in a CPU module. I1, I2, O1, and, O2 are internal registers in AH10SCM-5A. For a CPU module, **D Register** or **Base+Offset** can be selected.

Register	Definition	Register	Definition
D	Internal data register in a CPU module	Base+Offset	Used with a control register
I1	Used for the receiving/sending of data through COM1	O1	Used for the sending of data through COM1
I2	Used for the receiving/sending of data through COM2	O2	Used for the sending of data through COM2

- Length
  Class: Users can select **1 Byte** or **2 Bytes** in the **Class** box.
  Format: Users can select **Hex** or **ASCII** in the **Format** box.
  Value: Users can enter a length.
- Checksum
  Class: Users can select a class.
  Format: Users can select the format of a checksum
  Initial value: Users can set an initial value.
  Reverse: The high byte of a one-word checksum which is calculated, and the low byte of the checksum are reversed.

8.6.3.2 Command

After several TX packets and RX packets are created, users can select packets which will be sent and packets which will be received by creating commands. Besides, the users can set the sequence of executing the commands.



Command number: Every command is numbered. Command numbers indicate execution sequence.
Command type: Users can select **Send**, **Receive**, or **Send** & **Receive** in the **Command Type** box.
Send packet: Users can select a packet which has been created.
Receive packet: Users can select a packet which has been created.
Success: Users can specify an action which follows the execution of a command. They can select **Next**, **Goto**, or **End**.
Next: The next command is executed. If the command which is being executed is command 1, the next command which will be executed is command 2.
Goto: Users can specify a command which should be executed much later.

End: Coming to and end

Fail: Users can specify an action which follows the execution of a command. They can select **Next**, **Goto**, or **Abort**.

Next: The next command is executed. If the command which is being executed is command 1, the next command which will be executed is command 2.

Goto: Users can specify a command which should be executed much later.

Abort: Coming to and end

Retry: The sending of a command can be retried after the sending of the command fails. Users can set the number of times the sending of a command is retried.

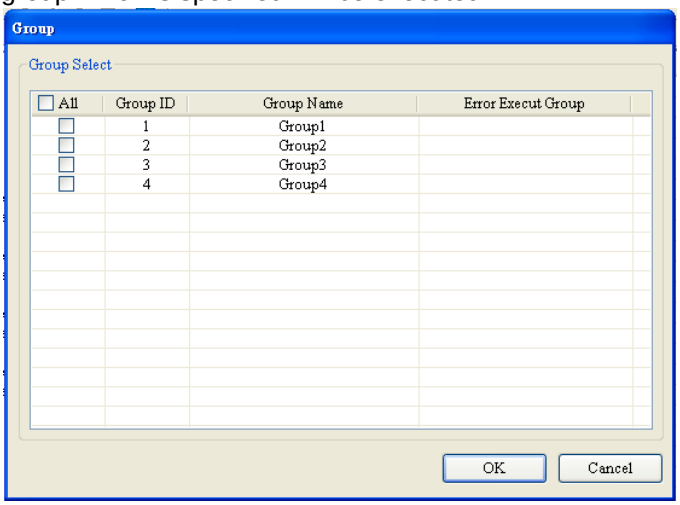
Repeat: After a command is executed successfully, it can be executed repeatedly. Users can set the number of times the execution of a command is repeated.

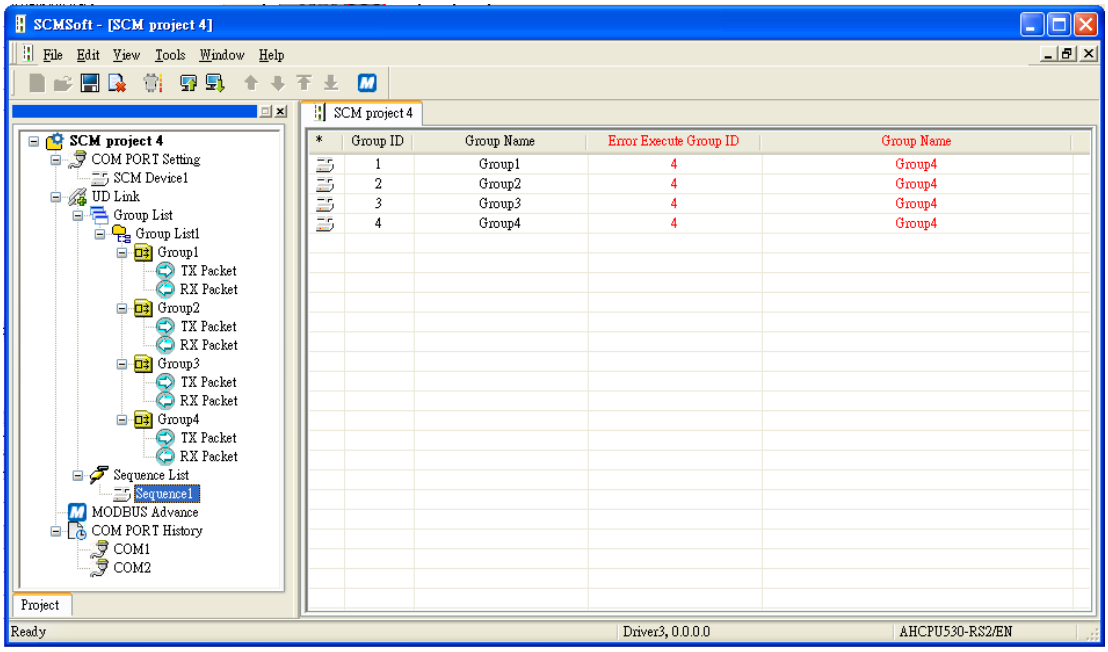
Send wait: Users can set an interval between commands. The default is 0 milliseconds, that is, the next command is sent after a reply is received.

Timeout: If no reply is received after a specific period of time, there is communication timeout. The default is 50 milliseconds.

8.6.3.3 Sequence

After users right-click a blank and click **Add Group**, they can select groups and set the sequence of executing the groups. After the sequence is downloaded, the packets in the groups will be sent/received through a communication port. Besides, the users can select groups which will be executed if errors occur by clicking the **Error Execute Group** column. If an error occurs when a group is executed, a group which is specified will be executed.





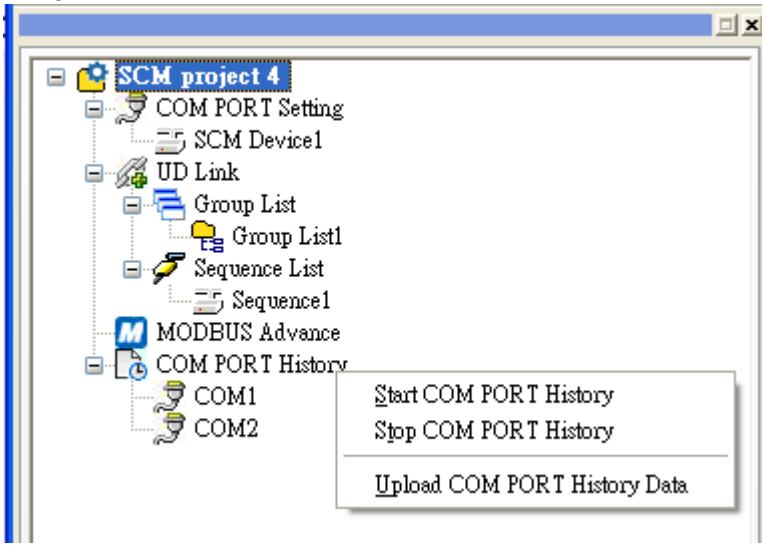
8.6.4 Modbus Advance

Please refer to the introduction in section 8.5 for more information.

8.6.5 COM Port History

During communication, all packets are recorded in a buffer zone in AH10SCM-5A. The COM port history helps users debug a program. Packets which are sent/received are recorded in this buffer zone. The capacity of the buffer zone is 2048 bytes. Only the latest communication data is recorded. The older communication data is discarded. Besides, the buffer zone is a non-latched area. Data in the buffer zone will disappear if there is a power failure. The COM port history function can be enabled and disabled. The data in the buffer zone can also be uploaded to SCMSoft.

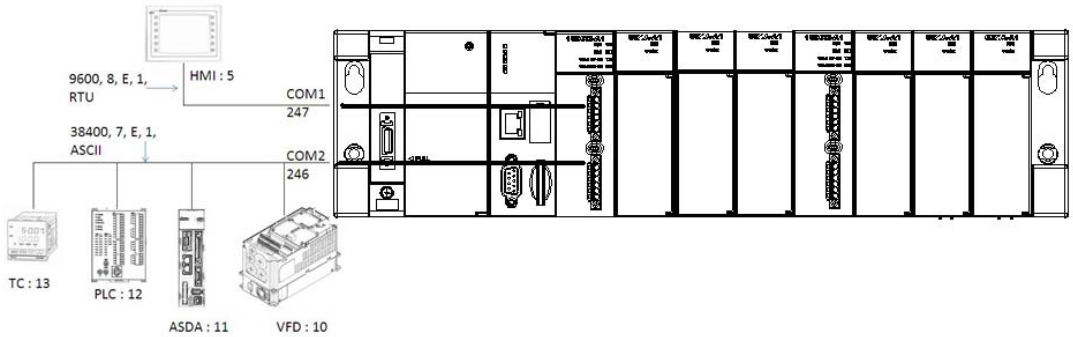
After users right-click **COM PORT History**, they can select **Start COM PORT History**, **Stop COM PORT History**, or **Upload COM PORT History Data**. If **Start COM PORT History** is selected, all communication through COM1 and COM2 will be recorded. If **Stop COM PORT History** is selected, the recording of all communication through COM1 and COM2 will stop. If **Upload COM PORT History Data** is selected, all communication data in AH10SCM-5A will be uploaded to SCMSoft. Please notice that the recording of all communication data stops before the data is uploaded to SCMSoft. If users want resume the recording of communication data, they must enable the COM port history function again.



8.7 Application

8.7.1 Modbus

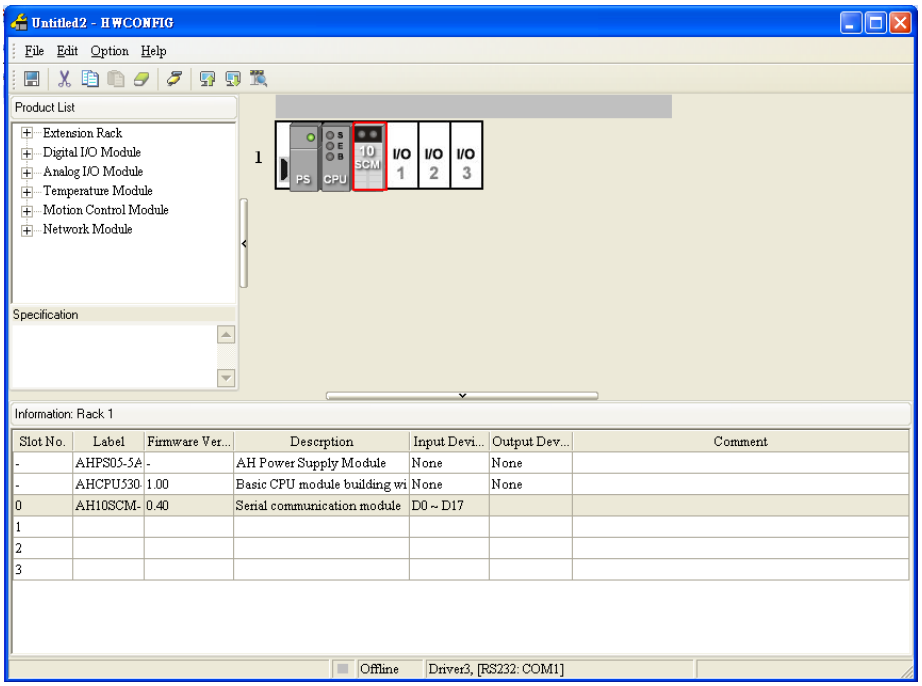
This section introduces the how AH10SCM-5A is connected to other Delta industrial products such as a human-machine interface, a temperature controller, a programmable logic controllers, an AC motor drive, and a servo motor through Modbus. The connection framework is as follows.



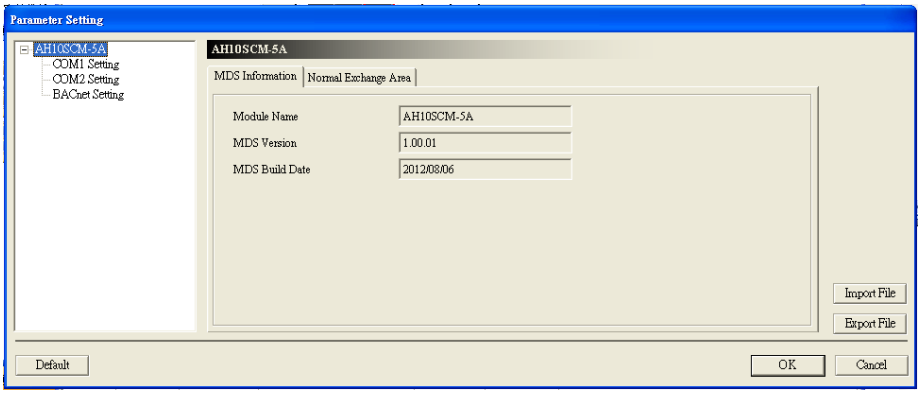
Product	Slave ID	Communication protocol	Device from which data is read	Register in the CPU module	Device into which data is written	Register in the CPU module
HMI	5	9600, RTU, 8, E, 1	-	-	-	-
VFD	10	38400, ASCII, 7, E, 1	16#2103	D100	16#2000 16#2001	D150~ D151
ASDA	11	38400, ASCII, 7, E, 1	16#0101 16#020A	D200 D201	16#0101 16#020A	D250 D251
PLC	12	38400, ASCII, 7, E, 1	D100~ D109	D300~ D309	D200~ D204	D350~ D354
TC	13	38400, ASCII, 7, E, 1	16#1000 (Present value)	D400	16#1001 (Setting value)	D451

8.7.1.1 Modbus Slave—Connection with Delta Products

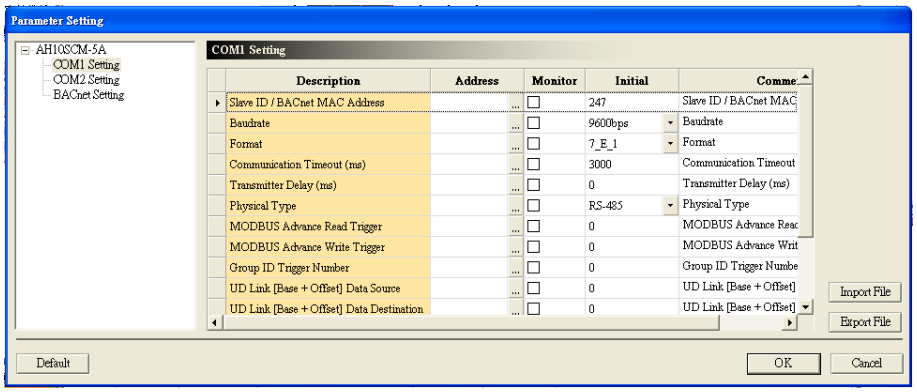
If AH10SCM-5A functions as a Modbus slave, users only need to set a slave ID and a transmission speed.
After the users double-click AH10SCM-5A in the **HWCONFIG** window, they can set communication parameters.



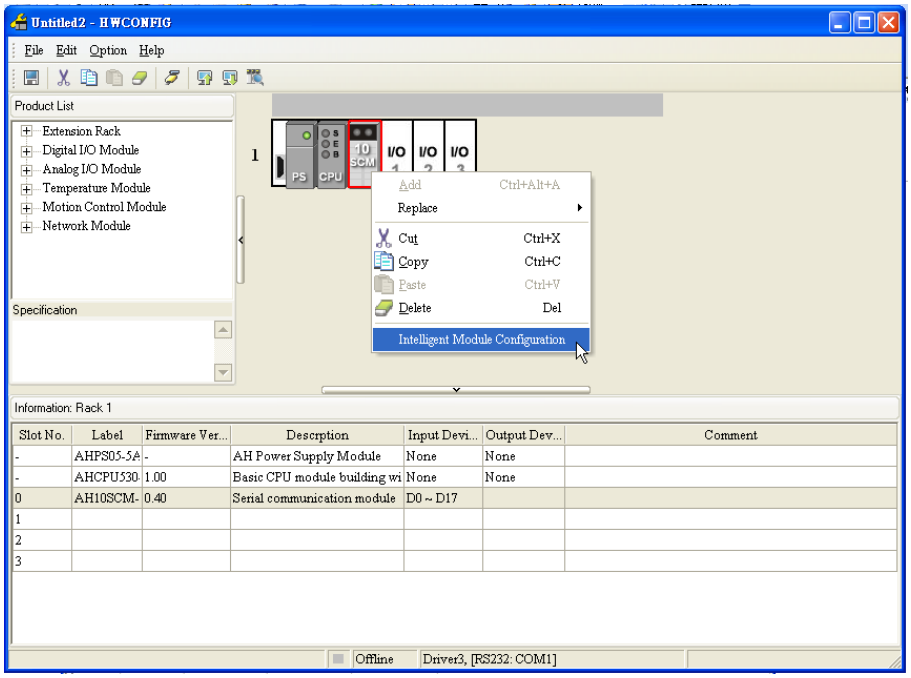
After the users click **AH10SCM-5A** in the **Parameter Setting** window, they can see the version of MDS, and the date when MDS is built.



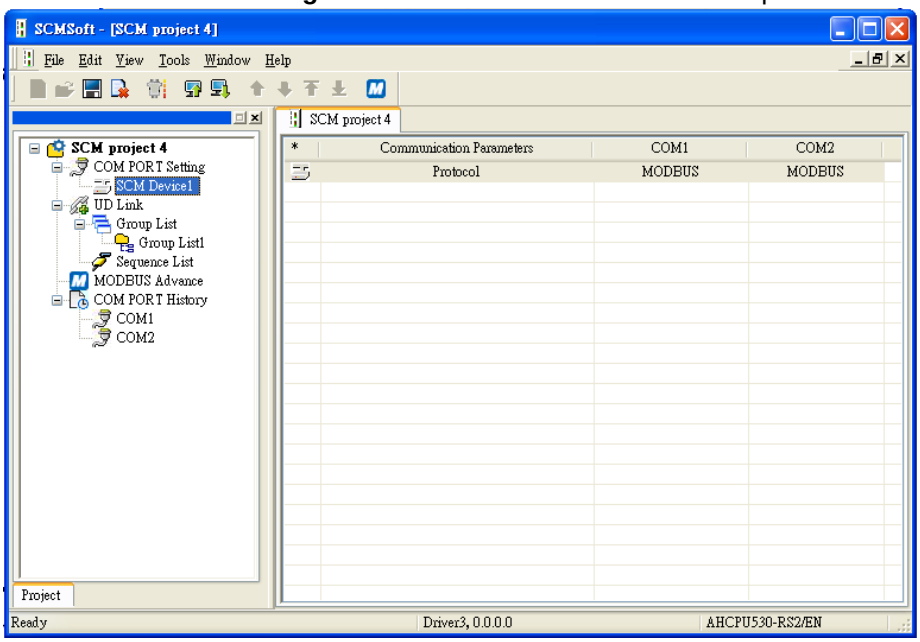
After the users click **COM1 Setting** in the **HWCONFIG** window, they can set communication parameters for COM1.


Parameter Setting
AH10SCM-5A
COM1 Setting
COM2 Setting
BACnet Setting
COM1 Setting
Description Address Monitor Initial Comme
Slave ID / BACnet MAC Address 247 Slave ID / BACnet MAC
Baudrate 9600bps Baudrate
Format 7_E_1 Format
Communication Timeout (ms) 3000 Communication Timeout
Transmitter Delay (ms) 0 Transmitter Delay (ms)
Physical Type RS-485 Physical Type
MODBUS Advance Read Trigger 0 MODBUS Advance Reac
MODBUS Advance Write Trigger 0 MODBUS Advance Writ
Group ID Trigger Number 0 Group ID Trigger Numbe
UD Link [Base + Offset] Data Source 0 UD Link [Base + Offset]
UD Link [Base + Offset] Data Destination 0 UD Link [Base + Offset]
Import File
Export File
Default
OK
Cancel

Right-click AH10SCM-5A in the **HWCONFIG** window, click **Intelligent Module Configuration** on the context menu, and click **Yes**. SCMSoft is started.

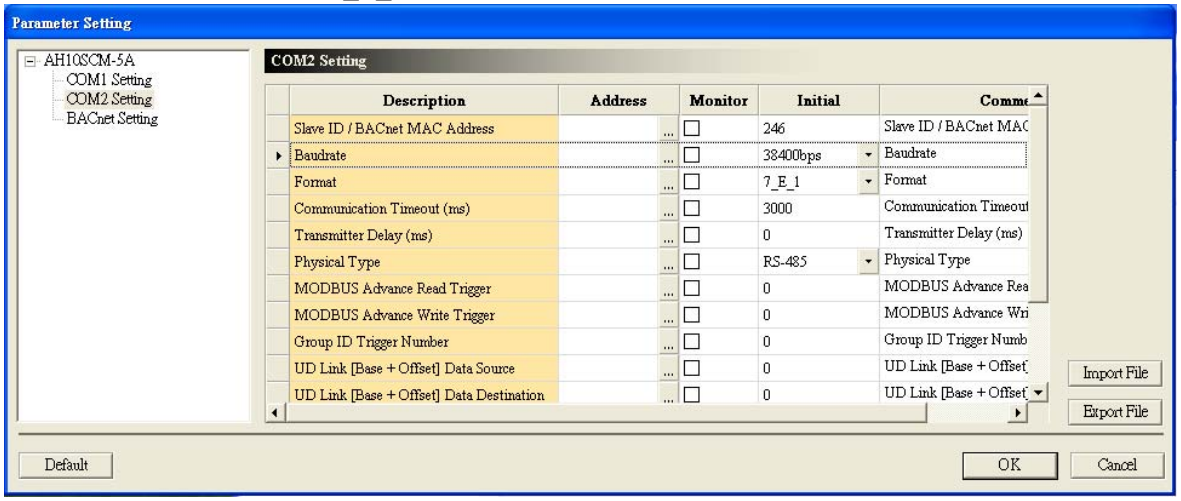


Start SCMSoft.→**COM PORT Setting**: **SCM Device1**→Set communication protocols.

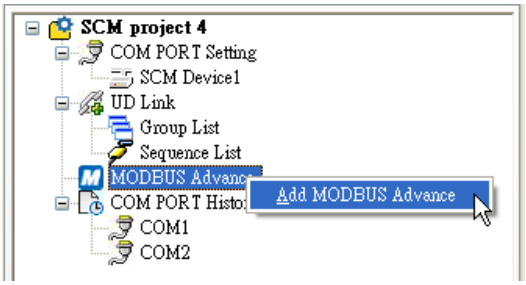


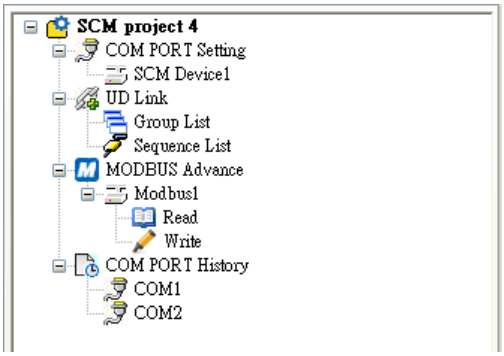
8.7.1.2 Modbus Master–Connection with Delta Products

(1) Setting communication parameters for COM2:
Slave ID: 246 (default)
Transmission mode: ASCII
Transmission speed: 38400 bps
Communication format: 7_E_1

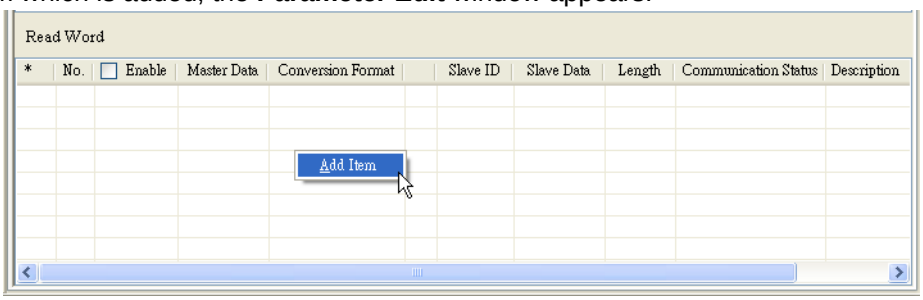


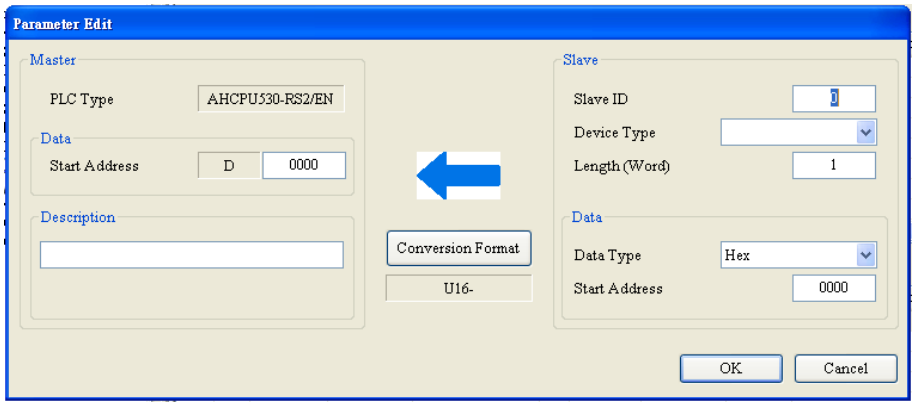
(2) Start SCMSoft, right-click **MODBUS Advance**, and click **Add MODBUS Advance**.



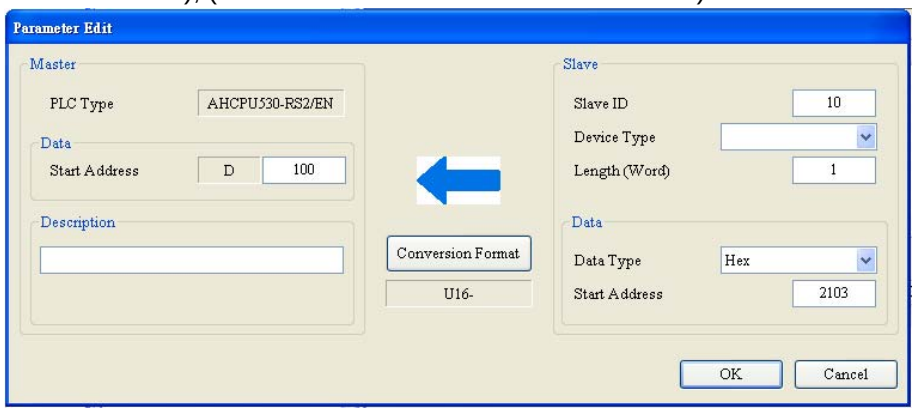


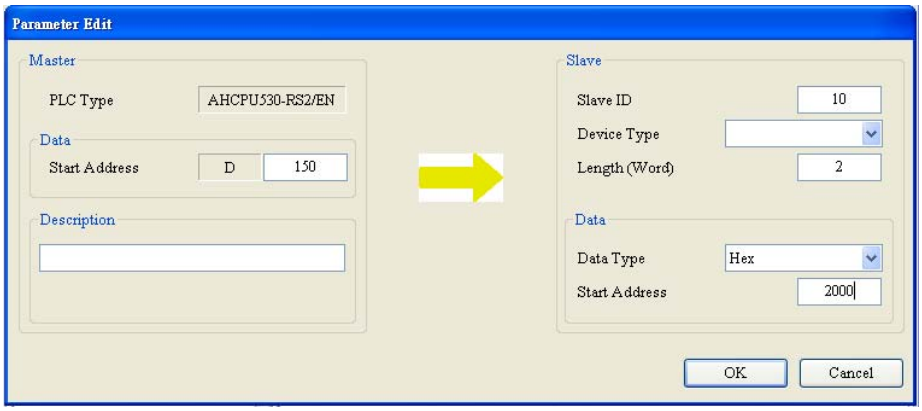
(3) Setting data exchange: Right-click a blank, and then click **Add Item**.→After users double-click the item which is added, the **Parameter Edit** window appears.



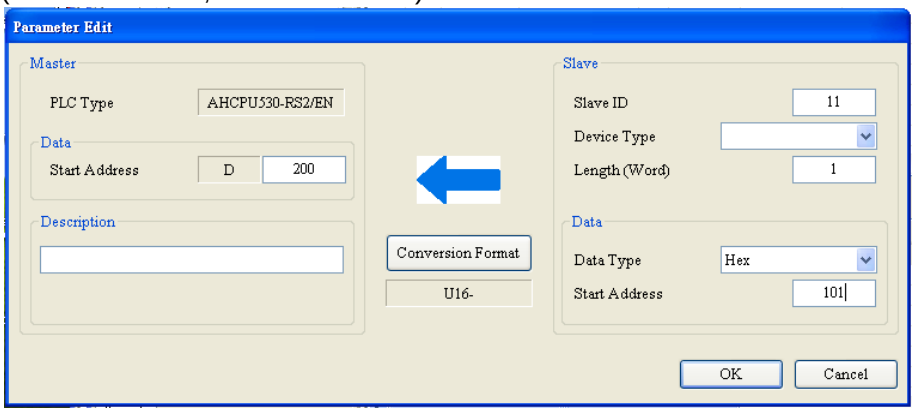


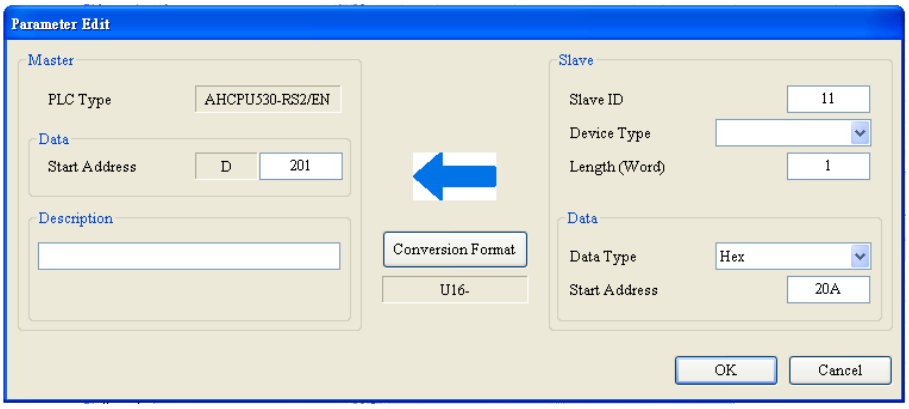
VFD: (D100←16#2103); (D150 and D151→16#2000 and 16#2001)



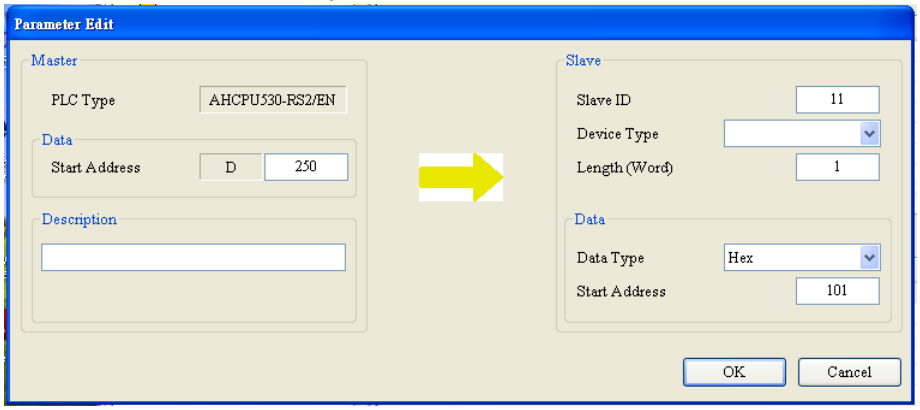


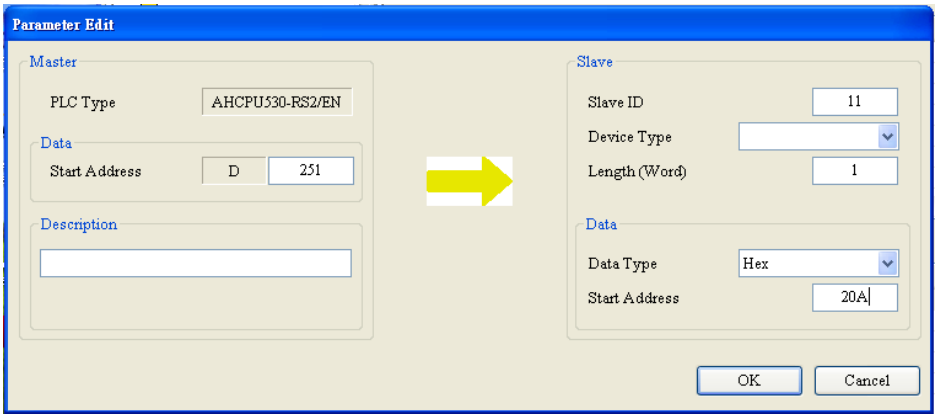
ASDA: (D200←16#0101; D201←16#020A)





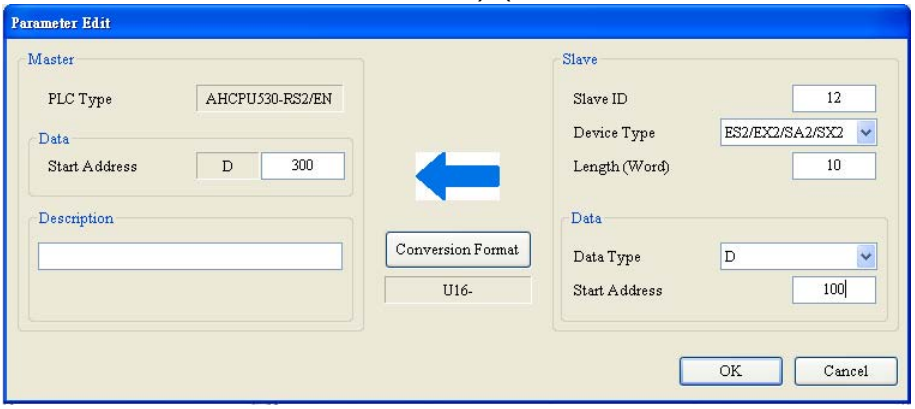
(D250→16#0101; D251→16#020A)

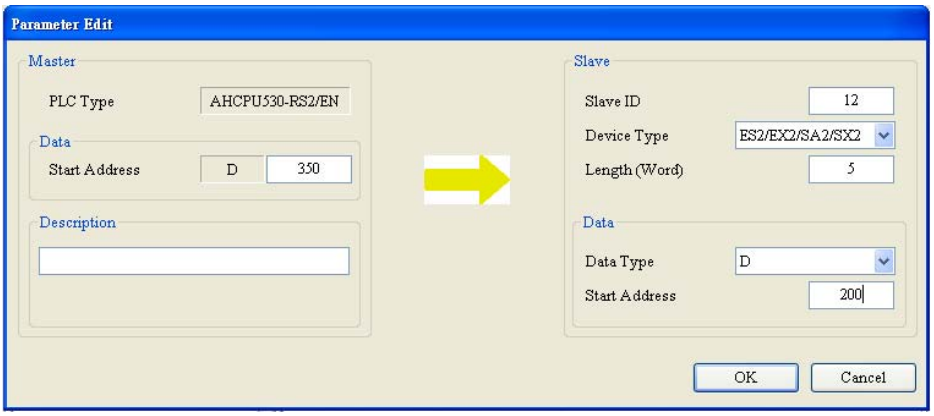




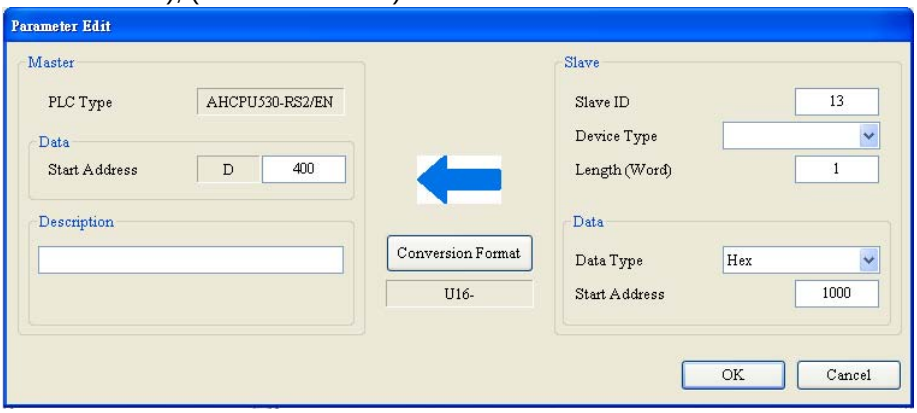
8

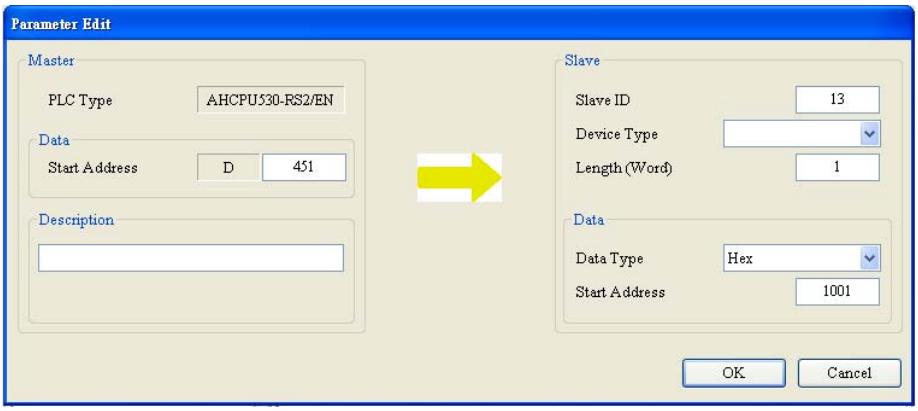
PLC: (Master: D300~D309←Slave: D100~D109); (Master: D350~D354→Slave: D200~D204)



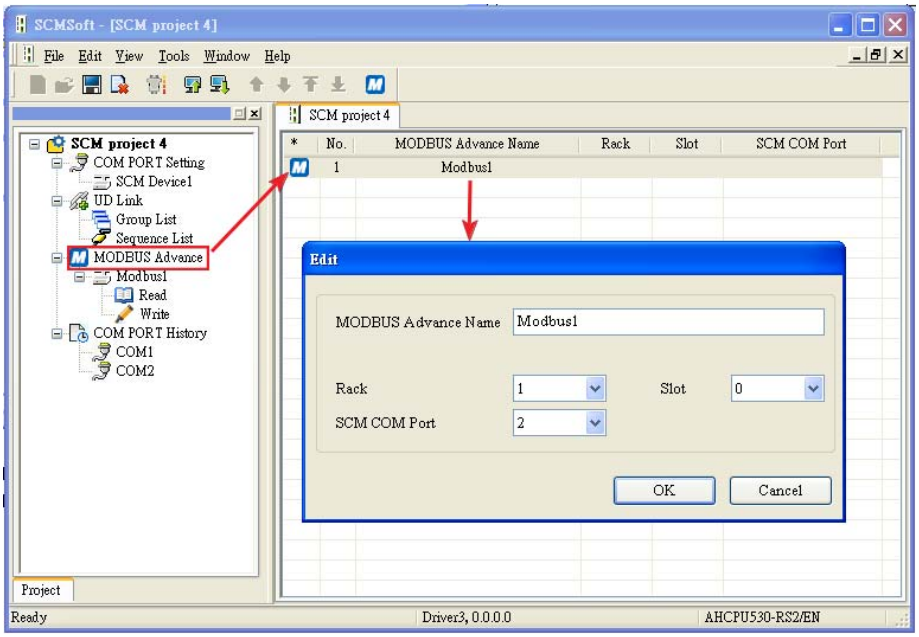


TC: (D400←16#1000); (D451→16#1001)



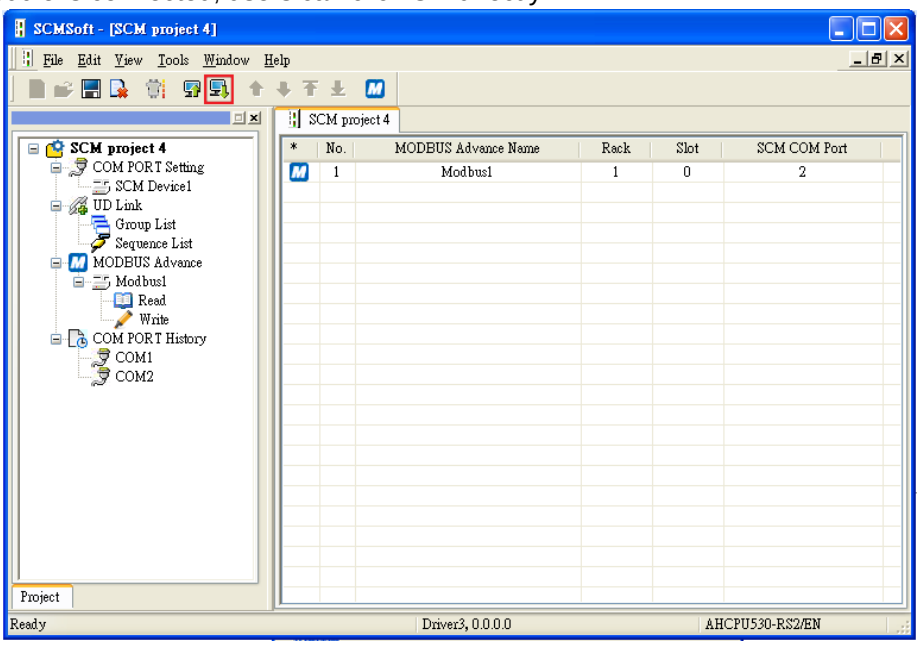


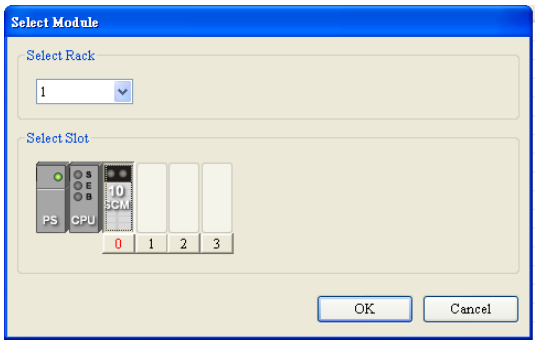
Click **MODBUS Advance**, and double click **Modbus1**. Select **2** in the **SCM COM Port** box, select **1** in the **Rack** box, and select **1** in the **Slot** box.

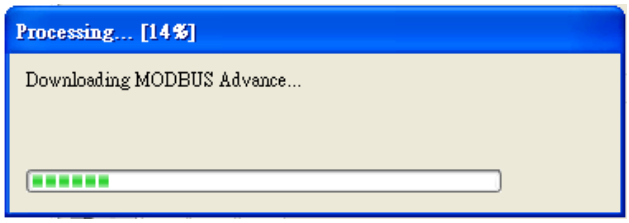


(4) Downloading parameters

Click **Download** on the toolbar, click a module which will be downloaded, and click **OK**. If only one module is connected, users can click **OK** directly.







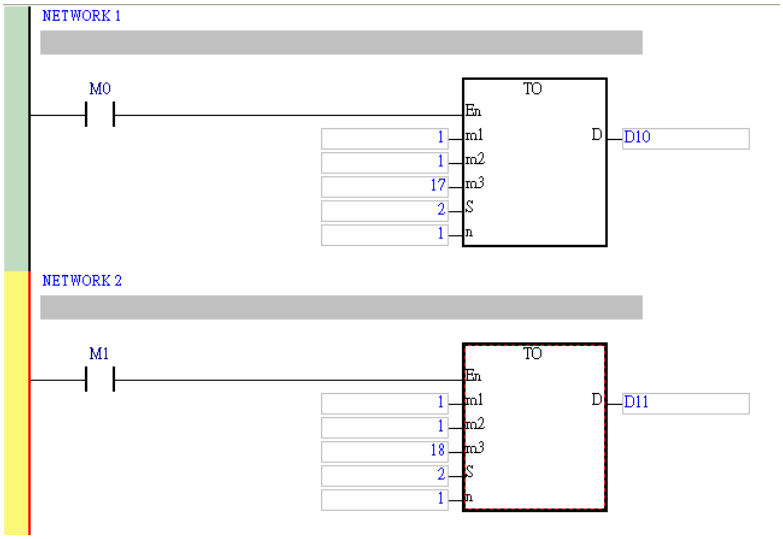
(5) Triggering the reading/writing of data

Users can use the instruction TO in ISPSoft to trigger the reading of data from bit devices/word devices, and the writing of data into bit devices/word devices. (CR#7,CR#8, CR#17, and CR#18)

CR#	Attribute	Register name	Description
7	R/W	Triggering the reading of data through COM1	High byte: Reading data from bit devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
17	R/W	Triggering the reading of data through COM2	High byte: Reading data from bit devices Low byte: Reading data from word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
8	R/W	Triggering the writing of data through COM1	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it
18	R/W	Triggering the writing of data through COM2	High byte: Writing data into bit devices Low byte: Writing data into word devices 0: Not triggering it 1: Triggering it once 2: Always triggering it

If users want to continually trigger the reading of data from word devices, they can write 2 into CR#17. If users wan to trigger the reading of data from word devices once, they can write 1 into CR#17.

If users want to continually trigger the writing of data into word devices, they can write 2 into CR#18. If users wan to trigger the writing of data into word devices once, they can write 1 into CR#18.



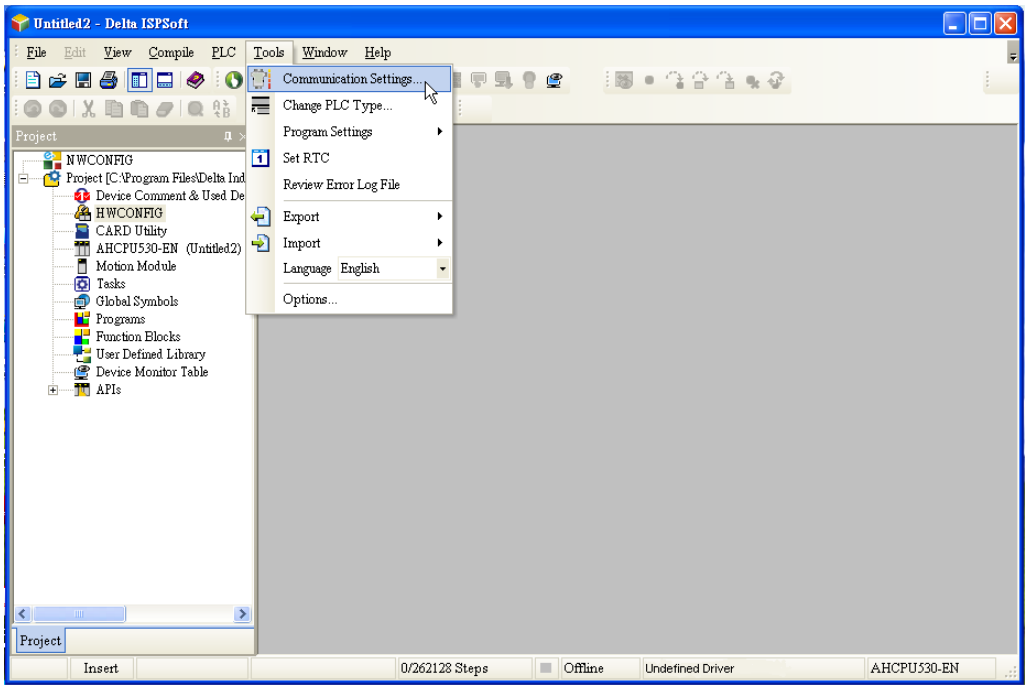
After M0 is triggered, data will be read from a device in a slave thorough COM2.
After M1 is triggered, data will be written into a device in a slave through COM2.

8.7.2 Connecting to ISPSoft

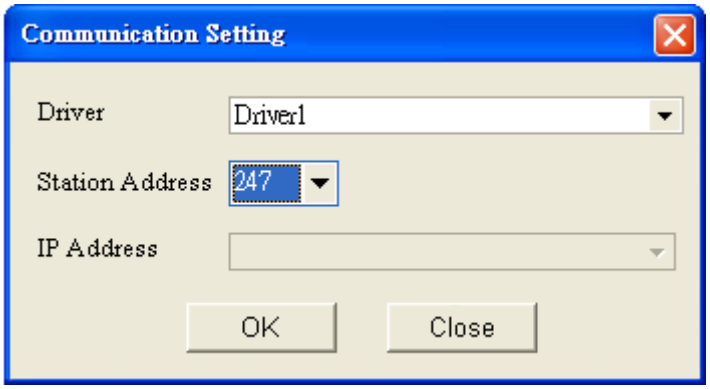
AH10SCM-5A can be used as an additional communication port for an AH500 series CPU module. ISPSoft can be connected to the AH500 series CPU module through a communication port on AH10SCM-5A. The default communication format of COM1 on AH10SCM-5A is “9600, 7, Even, 1”. The slave ID is 247.

(1) Setting ISPSoft

Start ISPSoft, and click **Communication Settings...** on the **Tools** menu.



(2) Select **Driver1** in the **Driver** box. (The communication format of COM1 set by COMMGR is "9600, 7, Even, 1".) Please notice that the station address in the **Communication Setting** window must be the same as the slave ID set for COM1. The station address is not the station address of the AH500 series CPU module.



(3) After users click OK, a program can be downloaded to or uploaded from the AH500 series CPU module.

8.7.3 RS-485

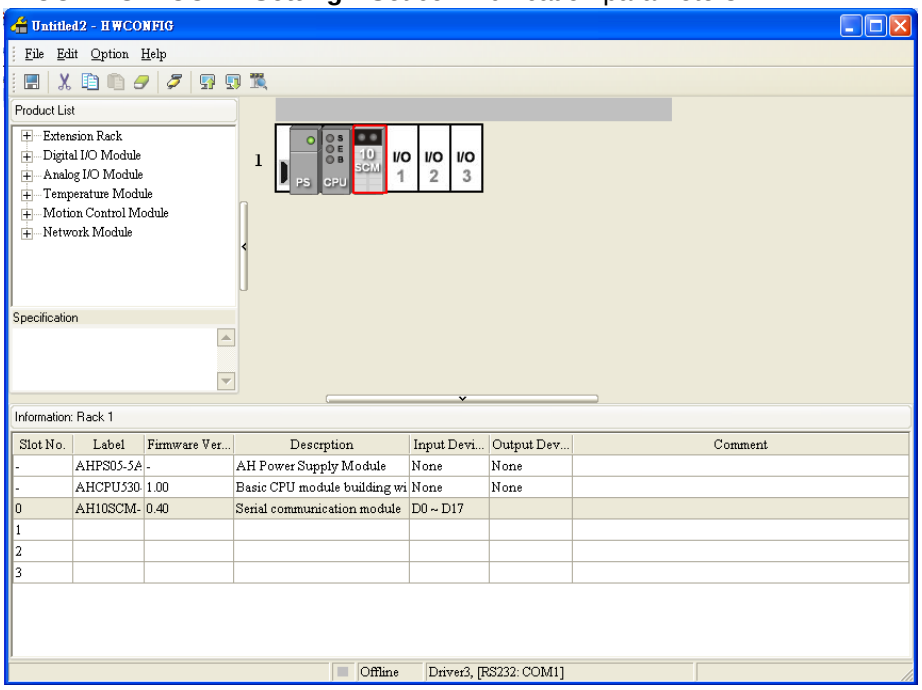
This section introduces how AH10SCM-5A is connected to other industrial products through a non-Modbus RS-485 communication port on AH10SCM-5A.

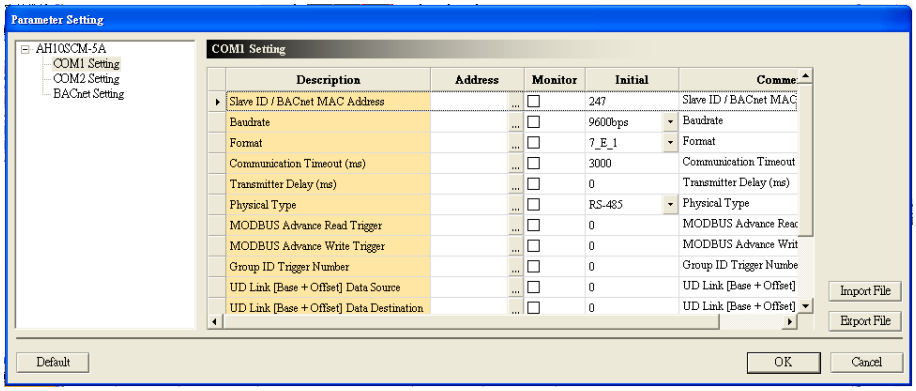
8.7.3.1 Connecting to a Power Meter

A power meter can be connected through Modbus, or through a RS-485 port. This section introduces how AH10SCM-5A is connected to a power meter through a UD Link RS-485 port on AH10SCM-5A.

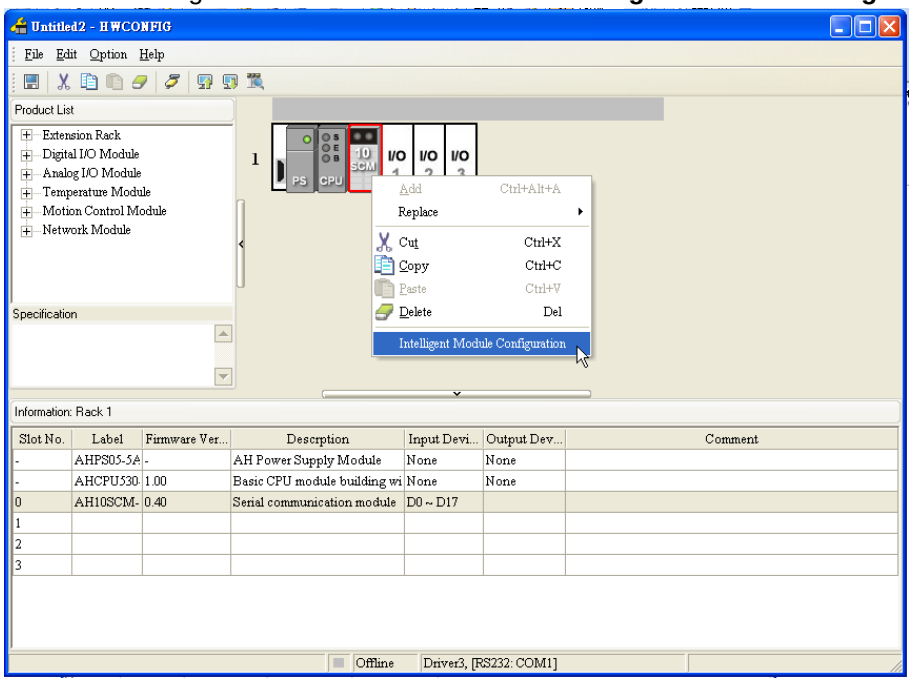
(1) Starting SCMSoft

Open HWCONFIG.→**COM1 Setting**→Set communication parameters.

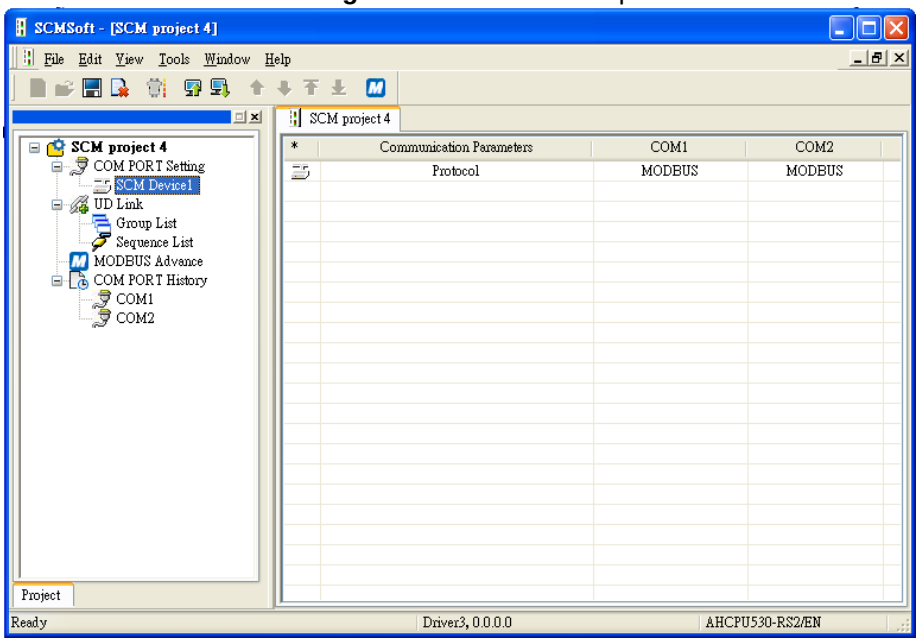




Open HWCONFIG.→Right-click AH10SCM-5A.→Click **Intelligent Module Configuration**.



Start SCMSoft.→**COM PORT Setting**→Set communication protocols.



(2) Record types

The slave ID of the power meter is 5. All telegrams consist of one of three types of records. These types of records are abbreviated records, control records, and full records. The use of these record types is described below.

〈Abbreviated record〉

Character number	Contents	Description
1	16#10	Start bit
2	16#00…16#FA, 16#FF	Instrument address (IA)
3		Function field (FF)
4		Checksum (CS) (CS=IA+FF)
5	16#16	End mark

〈Control record〉

Character number	Contents	Description
1	16#68	Start bit
2	16#03	Length
3	16#03	Length (repeat)
4	16#68	Start bit (repeat)
5	16#00…16#FA, 16#FF	Instrument address (IA)
6		Function field (FF)
7		Parameter index (PI)
8		Checksum (CS) (Summation of the characters starting from IA to PI)
9	16#16	End mark

〈Full record〉

Character number	Contents	Description
1	16#68	Start bit
2		Length
3		Length (repeat)
4	16#68	Start bit (repeat)
5	16#00…16#FA, 16#FF	Instrument address (IA)
6		Function field (FF)
7		Parameter index (PI)
…		n character, data block (DB)
Length+5		Checksum (CS) (Summation of the characters starting from IA to the last data type)
Length+6	16#16	End mark

(3) Usage

AH10SCM-5A can communicate with the power meter through the three types of records.

Type	Telegram to the power meter	Response (via a record type)
1	Resetting the instrument (via an abbreviated record)	None
2	Querying the status of the instrument (via an abbreviated record)	Abbreviated record
3	Most important measured values and errors (cyclic data) (via an abbreviated record)	Full record
4	Event data for error analysis (via an abbreviated record)	Full record

Type	Telegram to the power meter	Response (via a record type)
5	All measured values (via a control record)	Full record
6	Output parameters (via a control record)	Full record
7	Statuses (via a control record)	Full record
8	Instrument specifications (via a control record)	Full record
9	Real-time clock values (via a control record)	Full record

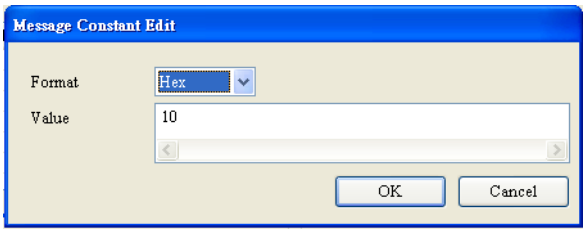
(4) Editing UD Link

Type 1: Sending an abbreviated record

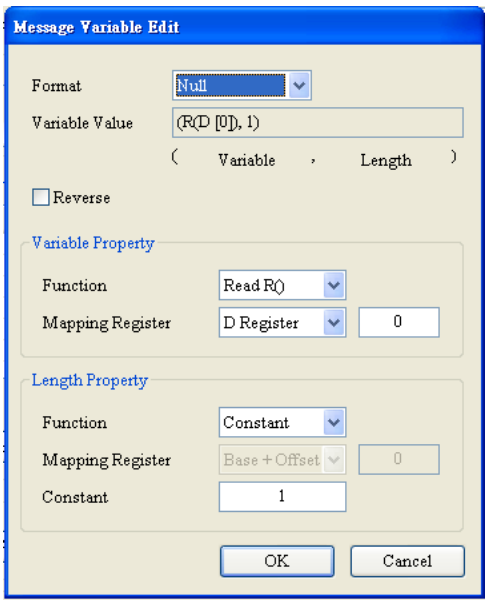
『Start bit』+『Instrument address (IA)』+『Function field (FF)』+『Checksum (CS)』+『End mark』

→16#10+D0+16#09+(IA+FF)+16#16

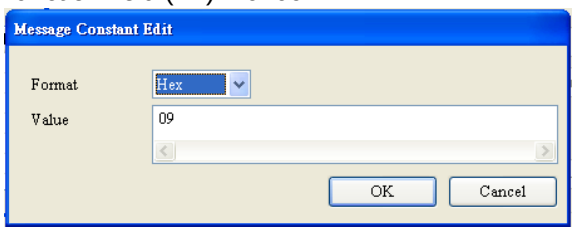
Start bit: 16#10



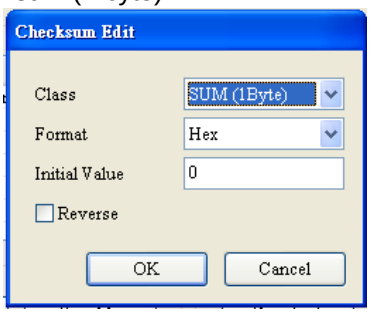
The instrument address (IA) is read from D0.

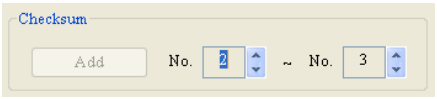


Function field (FF): 16#09

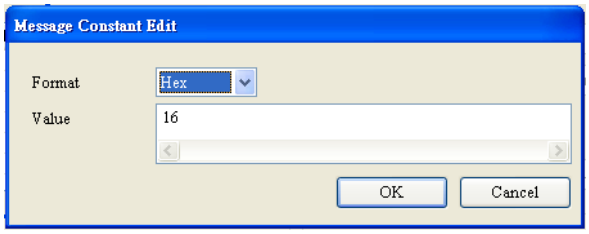


Checksum (1 byte): IA+FF

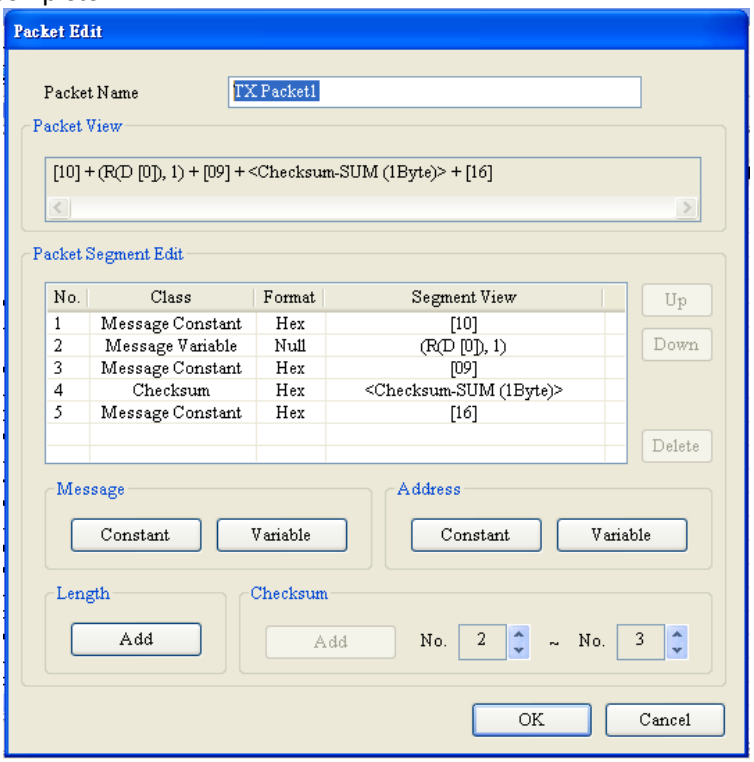




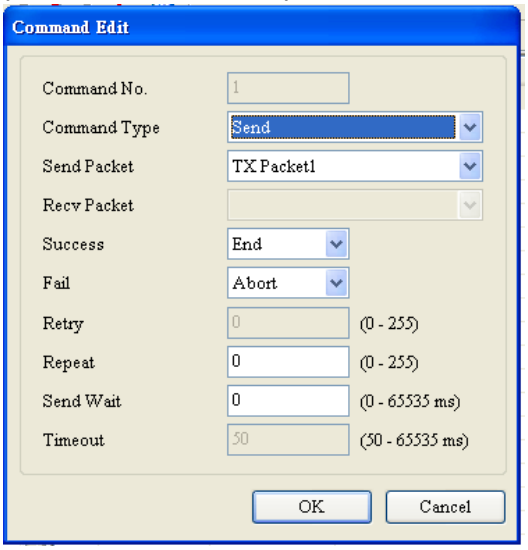
End mark: 16#16



The editing is complete.

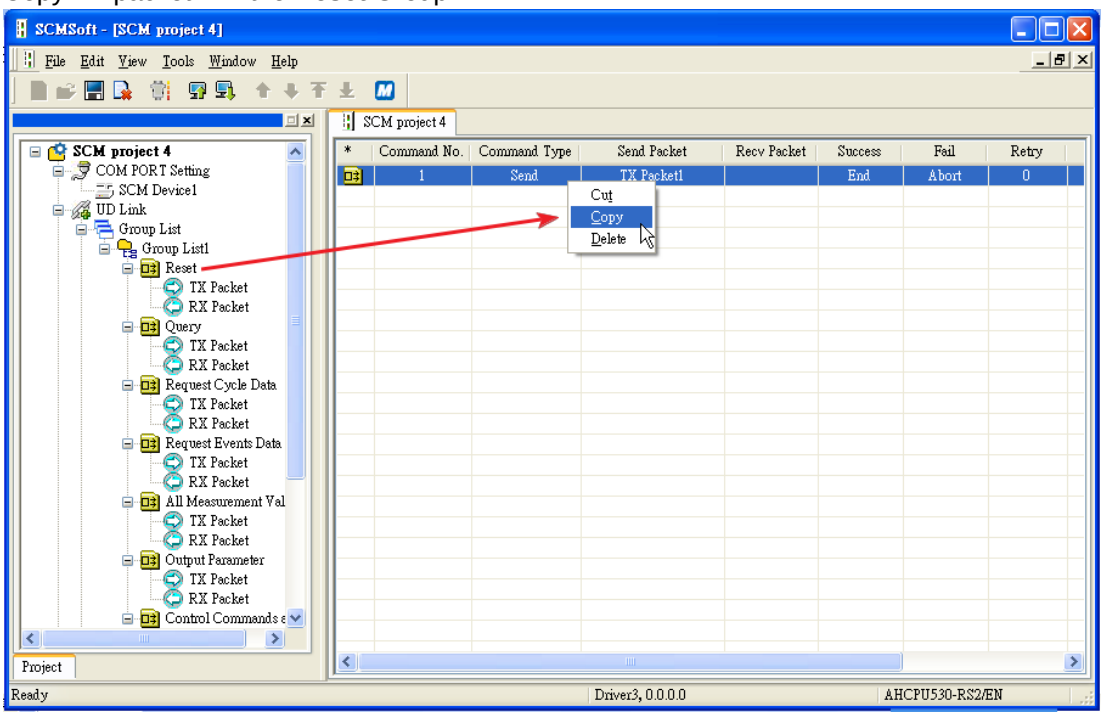


No response is needed. Users do not need to edit a RX packet.
Editing a command: TX packet 1 is sent. No response is needed.

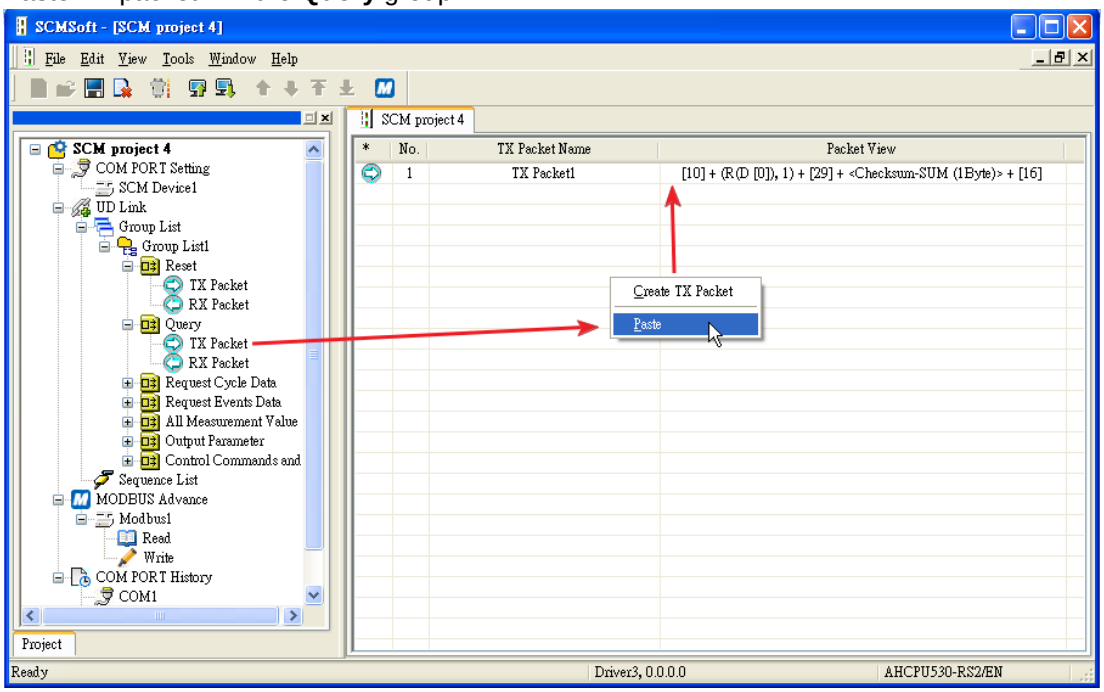


Type 2: Sending an abbreviated record, and receiving an abbreviated record
Sending an abbreviated record: The packet which will be sent is the same as TX packet 1 in type 1. The function field is 16#29.

Copy TX packet 1 in the **Reset** Group.



Paste TX packet 1 in the **Query** group.

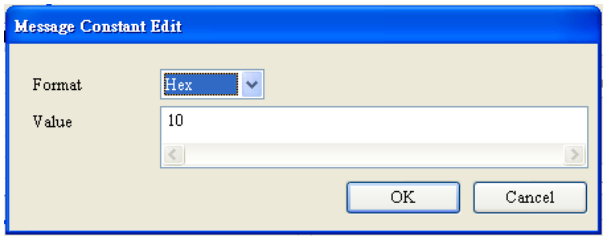


Receiving an abbreviated record:

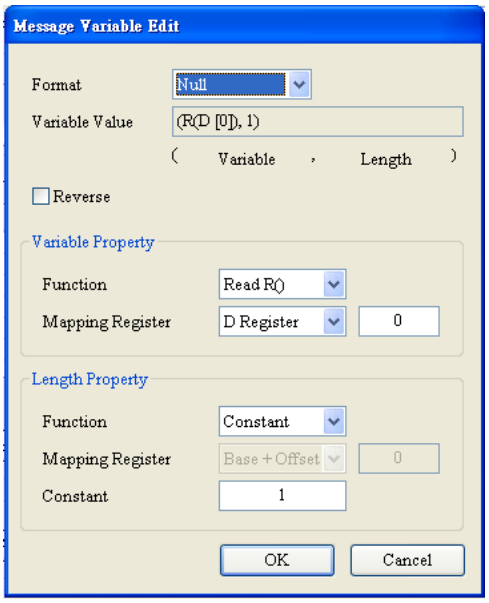
『Start bit』+『Instrument address (IA)』+『Function field (FF)』+『Checksum (CS)』+『End mark』

→16#10+D0+16#09+(IA+FF)+16#16

Start bit: 16#10

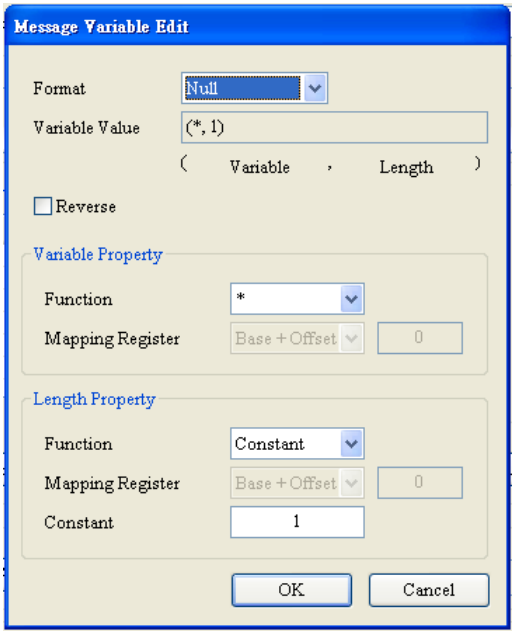


Instrument (IA): Check whether the instrument address received and the instrument address sent previously are the same.

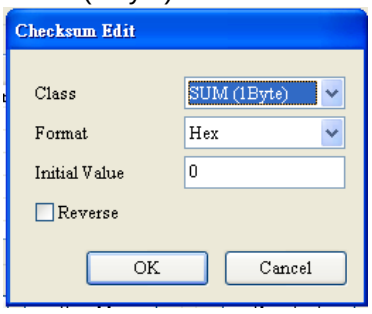


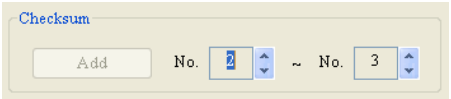
Function field (FF): (*, 1)

1 byte is ignored. If users wan to store the function field, they can store it in a data register.

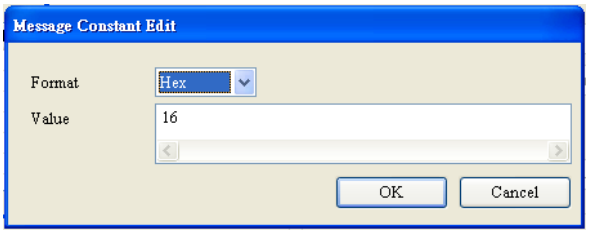


Checksum (1 byte): IA+FF

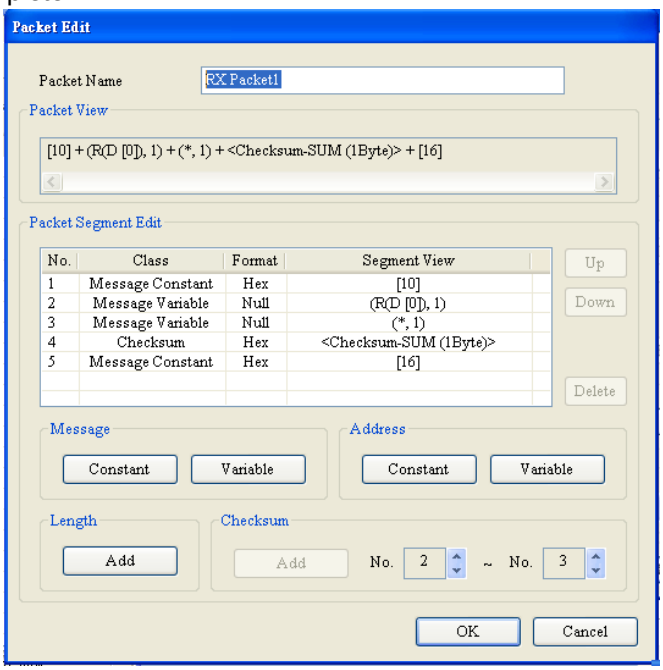




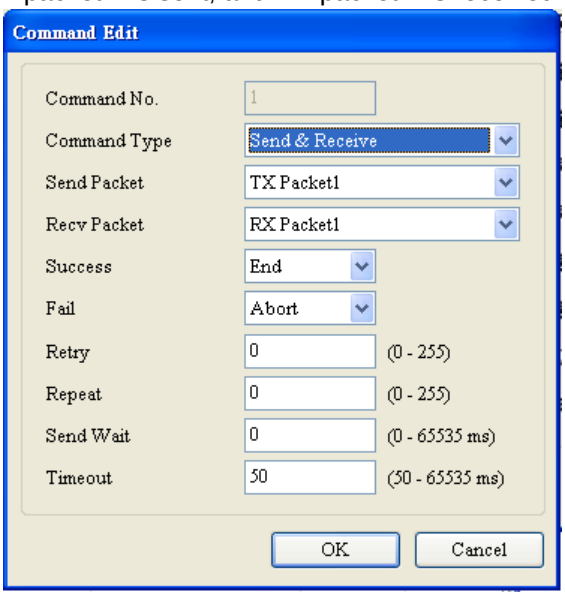
End mark: 16#16



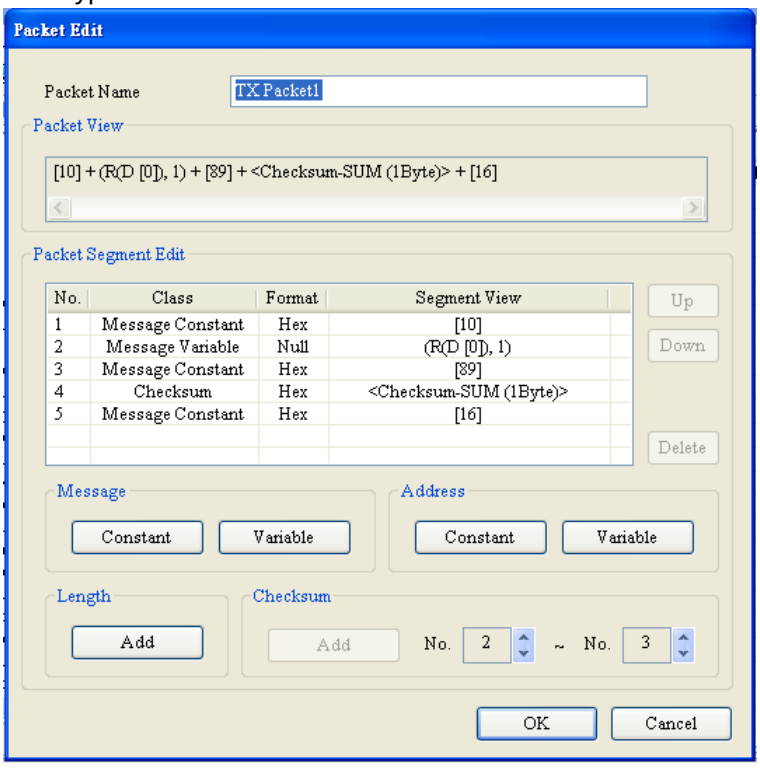
The editing is complete.



Editing a command: TX packet 1 is sent, and RX packet 1 is received.



Type 3: Sending an abbreviated record, and receiving a full record
Sending an abbreviated record: The packet which will be sent is the same as TX packet 1 in type 1 or TX packet 1 in type 2. The function field is 16#89.

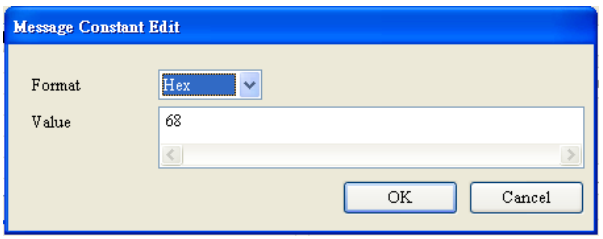


Receiving a full record:

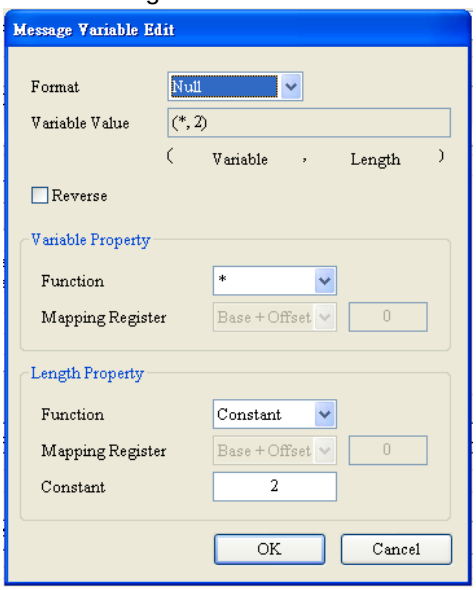
『Start bit』+『Length』+『Length (repeat)』+『Start bit (repeat)』+『Instrument (IA)』+『Function field (FF)』+『Parameter index (PI)』+『Data block (DB)』+『Checksum (CS)』+『End mark』

→16#68+(Null)+(Null)+16#68+D0+(Null)+D100

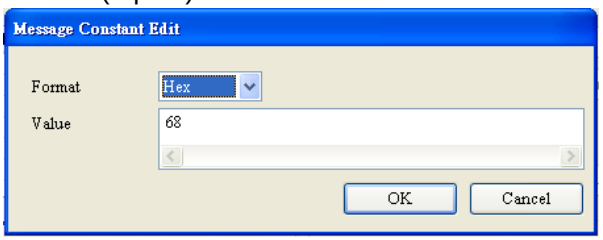
Start bit: 16#68



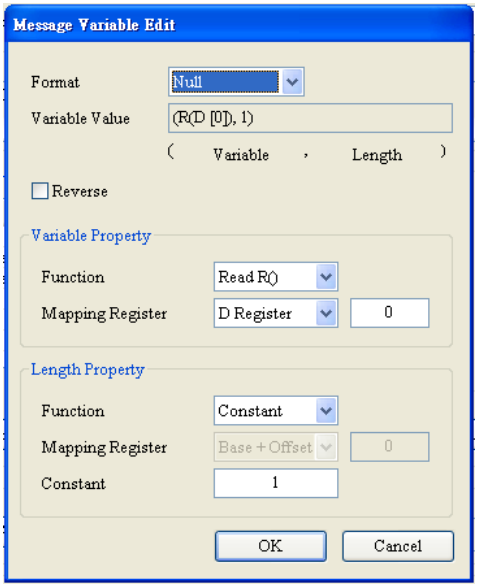
Length+Length (repeat): 2 bytes are ignored. Users can ignore the length or store the length.



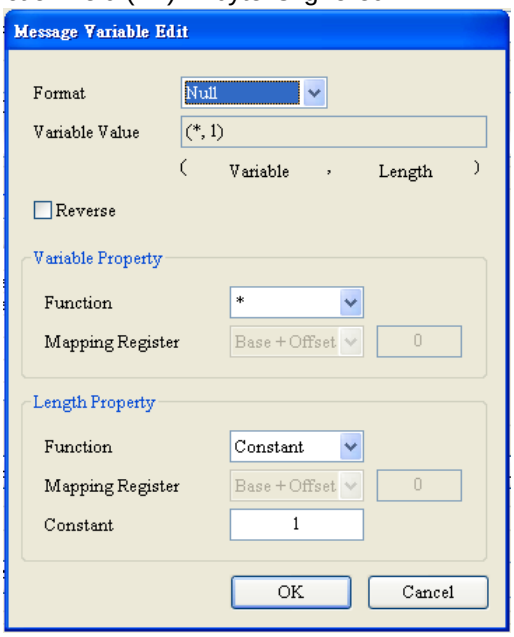
Start bit (repeat): 16#68



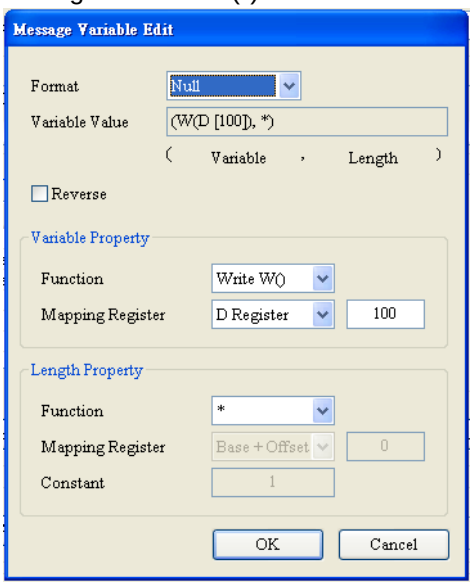
Instrument (IA): Check whether the instrument address received and the instrument address sent previously are the same.



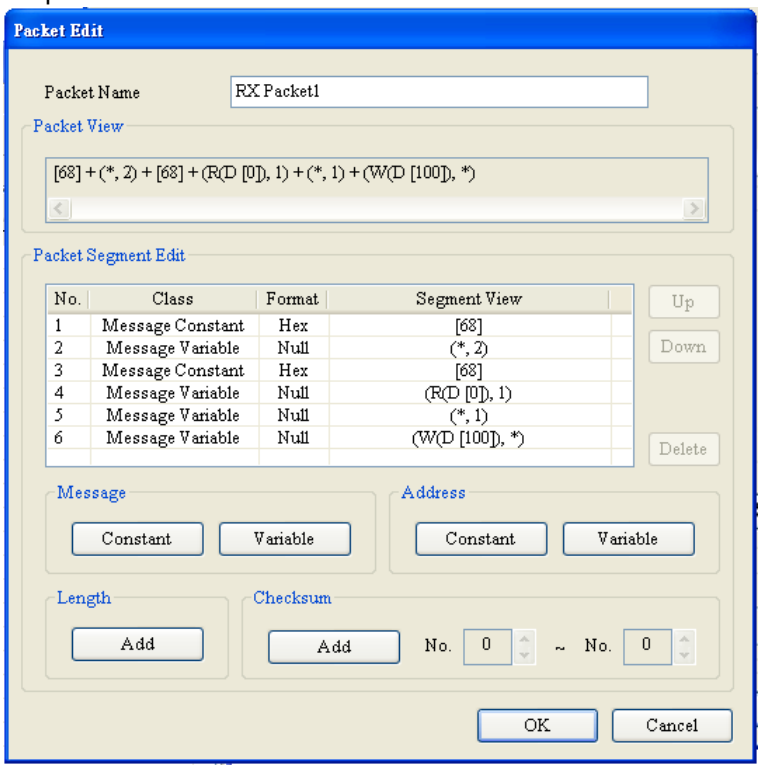
Function field (FF): 1 byte is ignored.



The data types following the function field are stored in the data registers starting from D100. (*)

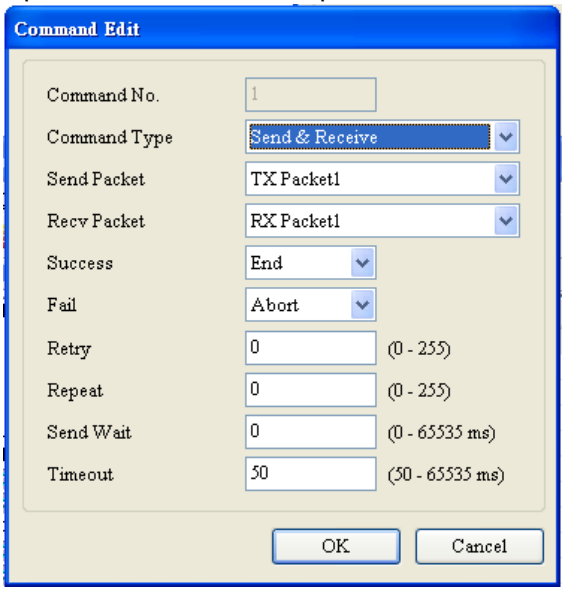


The editing is complete.

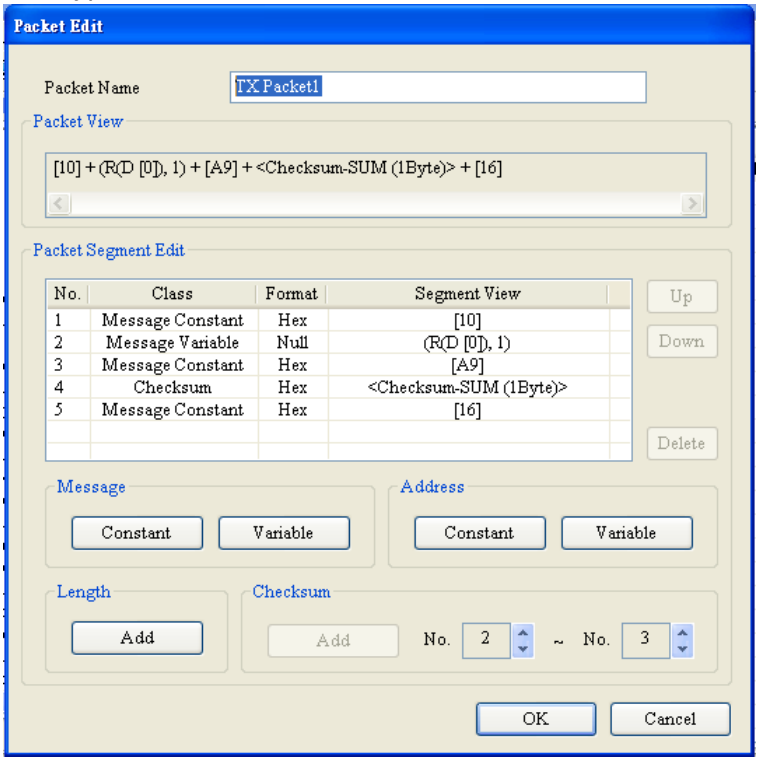


*: Users can ignore some unimportant bytes, and store data they need in data registers. Besides, if the length of data received is unknown, the users can store the data in data registers.

Editing a command: TX packet 1 is sent, and RX packet 1 is received.



Type 4: Sending an abbreviated record, and receiving a full record:
Sending an abbreviated record: The packet which will be sent is the same as TX packet 1 in type 1 or TX packet 1 in type 2. The function field is 16#A9.

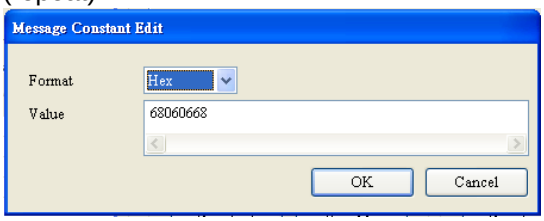


Receiving a full record:

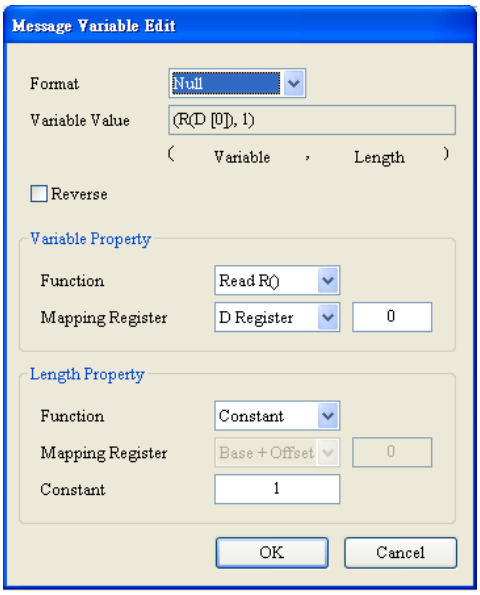
『Start bit』+『Length』+『Length (repeat)』+『Start bit (repeat)』+『Instrument (IA)』+『Function field (FF)』+『Parameter index (PI)』+『Data block (DB)』+『Checksum (CS)』+『End mark』

→16#68+16#06+16#06+16#68+D0+(Null)+(Null)+(Summation of the characters starting from IA to the last data type)+16#16

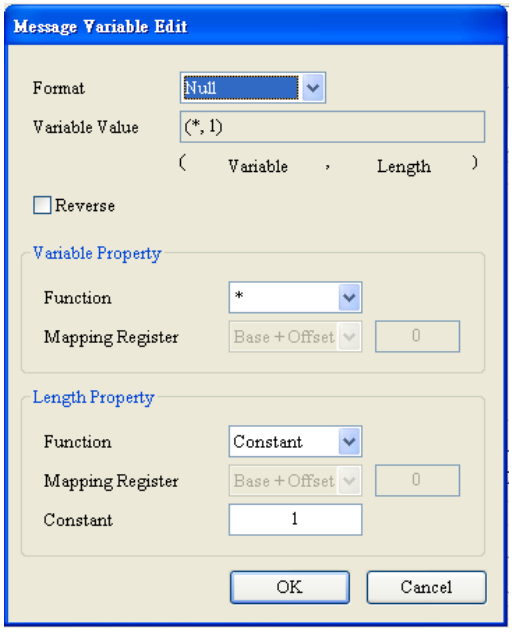
Start bit─Length─Length (repeat)─Start bit (repeat)



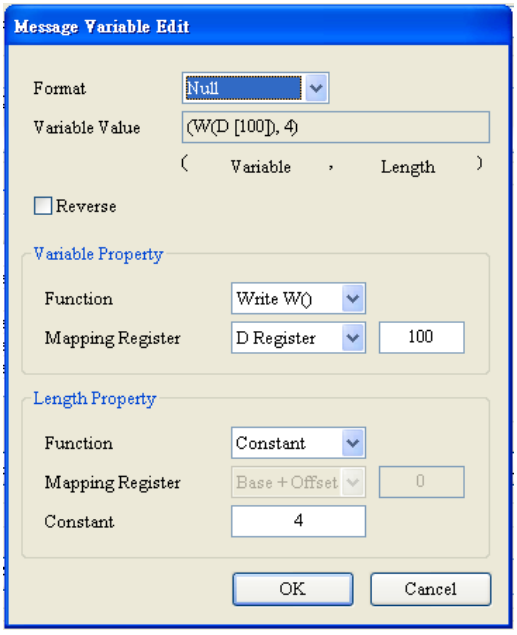
Instrument (IA): Check whether the instrument address received and the instrument address sent previously are the same.



Function field (FF): 1 byte is ignored.

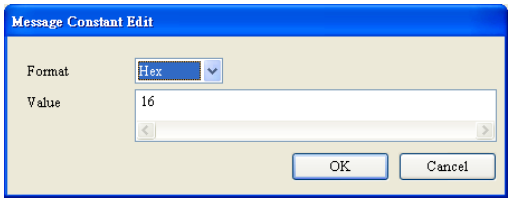


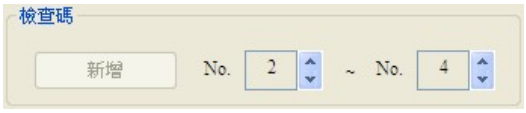
The parameter index and the data block are stored in the data registers starting from D100.



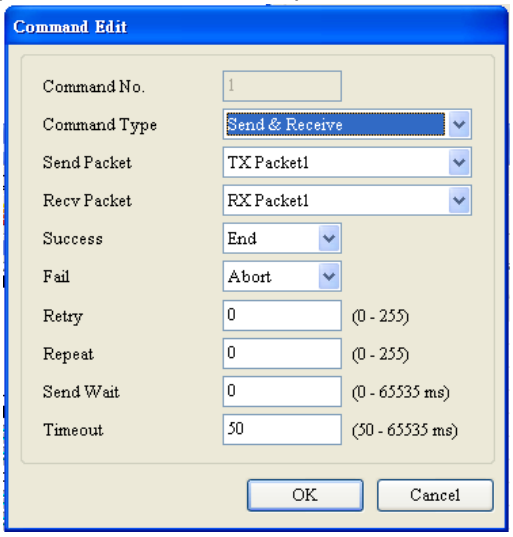
Checksum (CS)

End mark: 16#16





Editing a command: TX packet 1 is sent, and RX packet 1 is received.

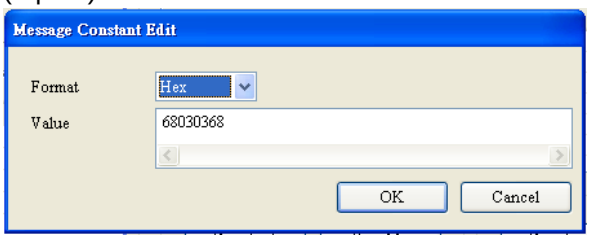


Type 5: Sending a control record, and receiving a full record:
Sending a control record: The function field is 16#89.

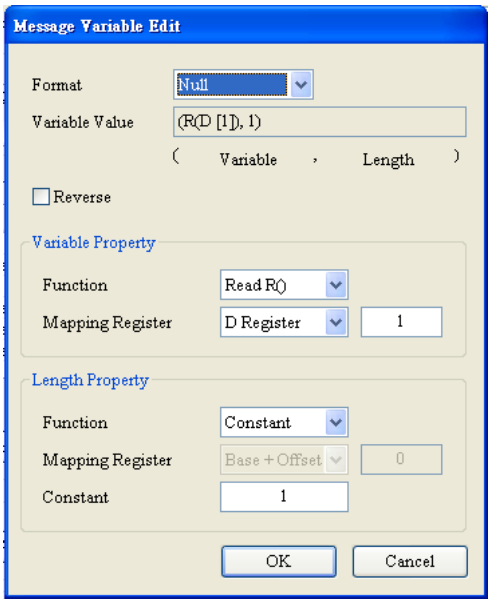
『Start bit』+『Length』+『Length (repeat)』+『Start bit (repeat)』+『Instrument address (IA)』+『Function field (FF)』+『Parameter index (PI)』+『Checksum (CS)』+『End mark』

→16#68+16#03+16#03+16#68+D0+16#89+D1+(Summation of the characters starting from IA to PI)+16#16

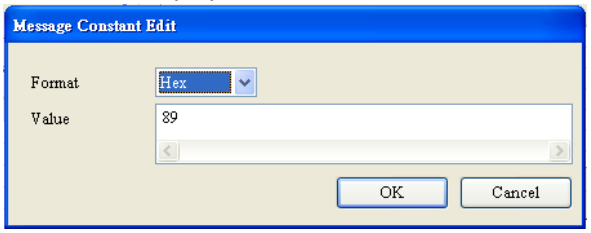
Start bit─Length─Length (repeat)─Start bit (repeat)



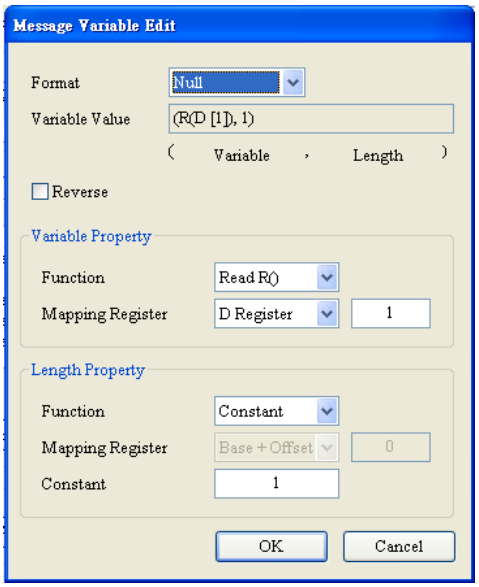
The instrument address (IA) is read from D0.



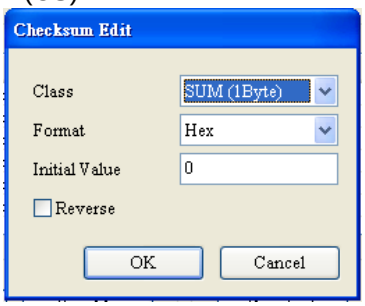
Function field (FF): 16#89

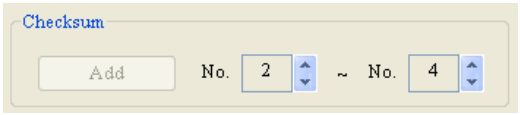


The parameter index (PI) is read from D1.

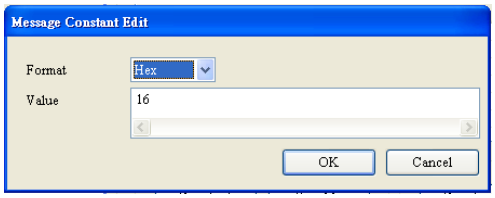


Checksum (CS)





End mark: 16#16

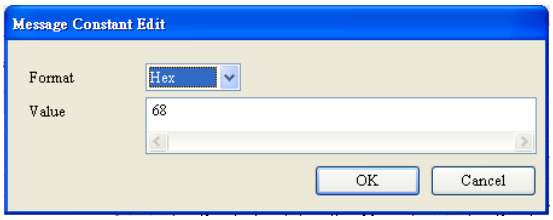


Receiving a full record:

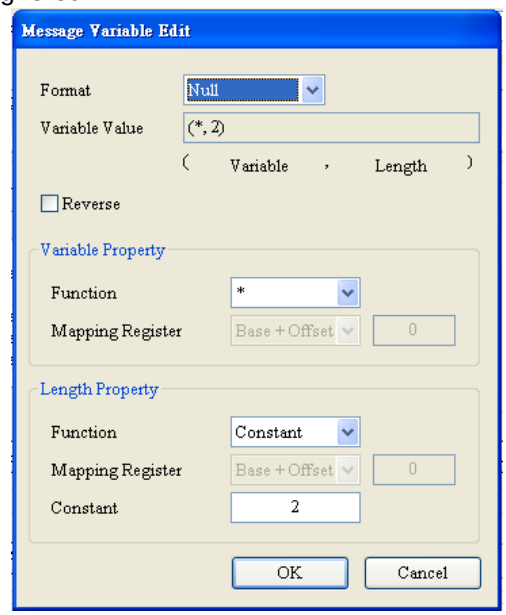
『Start bit』+『Length』+『Length (repeat)』+『Start bit (repeat)』+『Instrument (IA)』+『Function field (FF)』+『Parameter index (PI)』+『Data block (DB)』+『Checksum (CS)』+『End mark』

→16#68+(Null)+(Null)+16#68+D0+(Null)+D1+D100+(Summation of the characters starting from IA to the last data type)+16#16

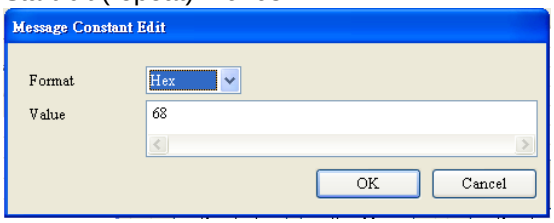
Start bit: 16#68



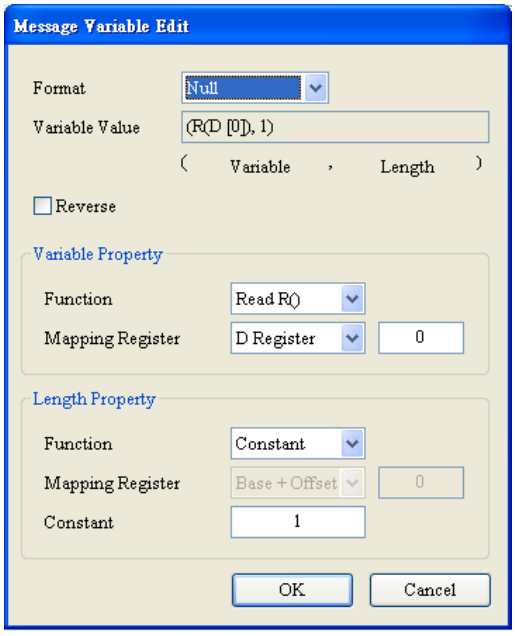
Length─Length (repeat): 2 bytes are ignored.



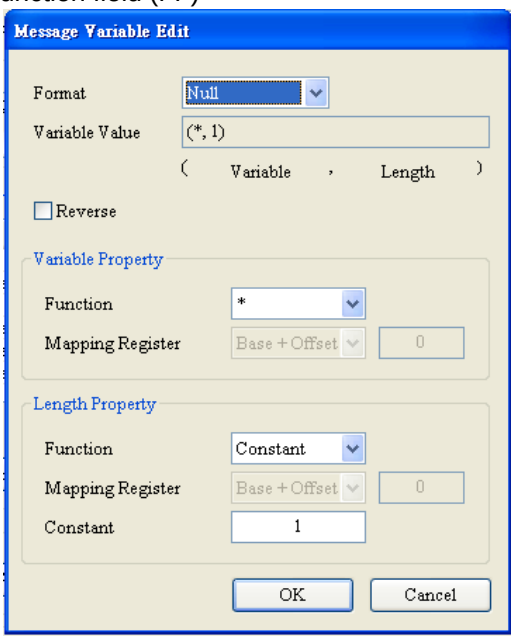
Start bit (repeat): 16#68



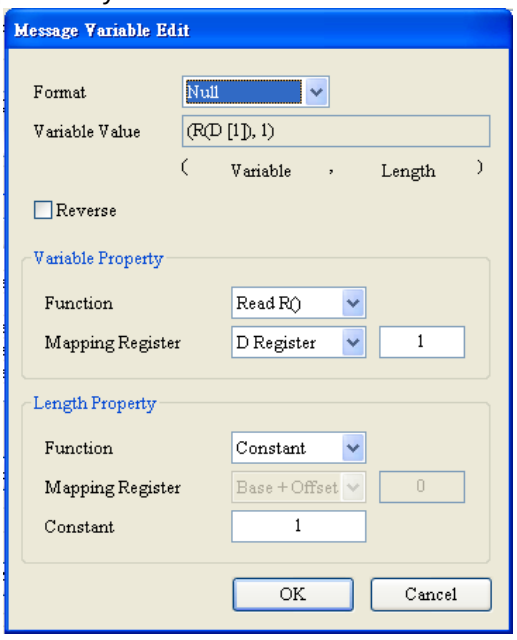
Instrument (IA): Check whether the instrument address received and the instrument address sent previously are the same.



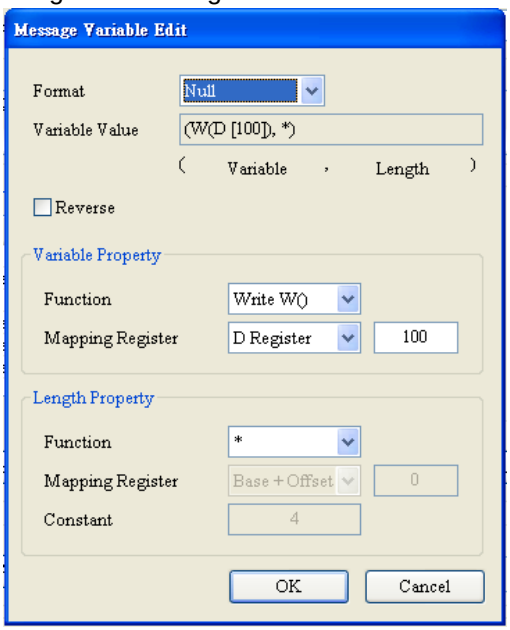
Function field (FF)



The parameter index received must be the same as the parameter index sent previously.



Data block (DB): The data received is stored in the registers starting from D100.



(5) Downloading a group list

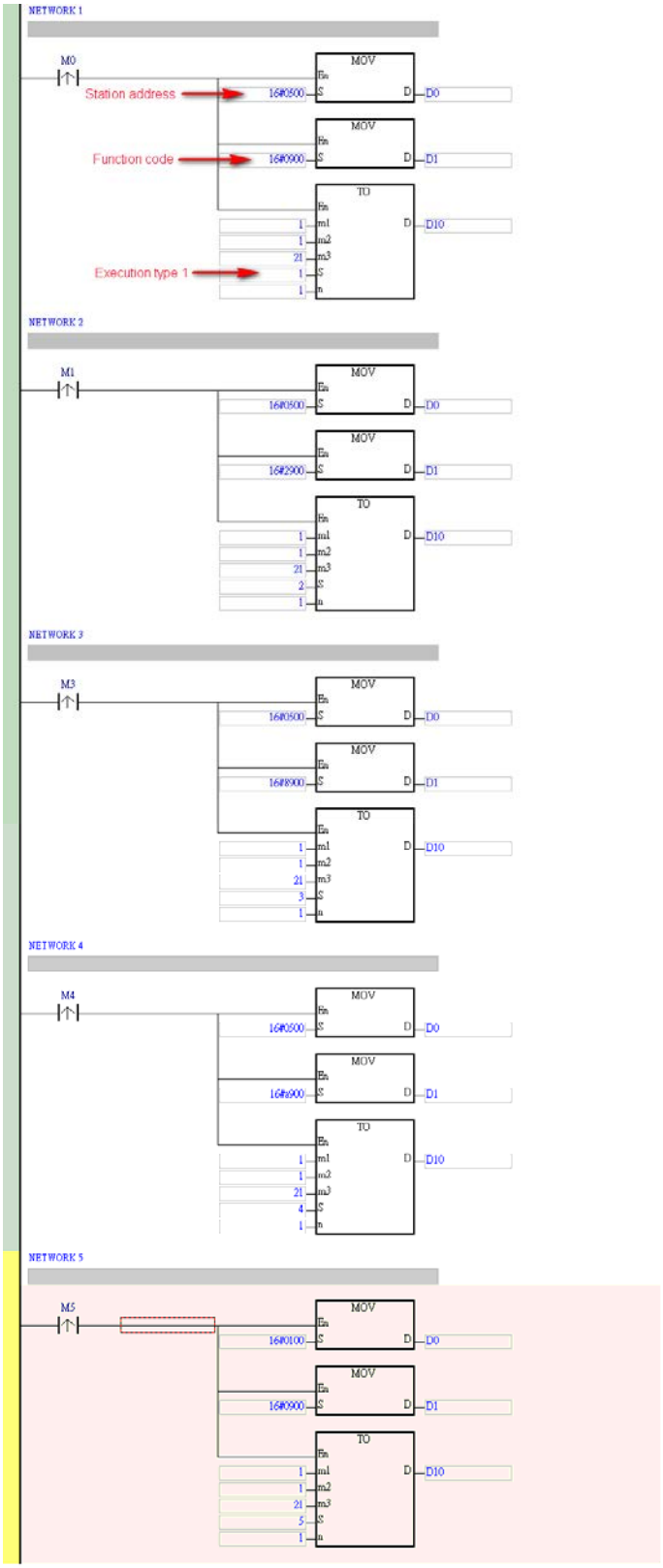
Users can click **Download** on the toolbar in SCMSoft.

(6) Triggering UD Link through ISPSoft

UD Link is triggered through ISPSoft. The sending/receiving of the packets in a group is triggered by the instruction TO. After 1 is written in CR#21, the sending/receiving of the packets in group 1 will be triggered. After 2 is written in CR#21, the sending/receiving of the packets in group 1 will be triggered.

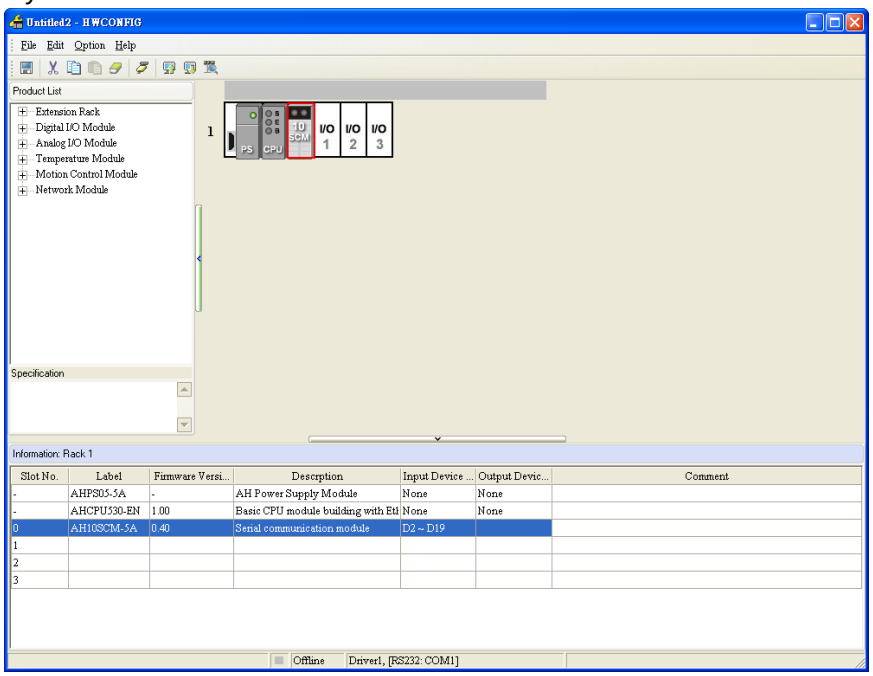
CR#	Attribute	Register name	Description
21	R/W	Triggering the sending/receiving of the packets in a group through COM1	Triggering the sending/receiving of the packets in a group through COM1

The sending/receiving of the packets in type 1~type 5 is controlled by M1~M5. The slave ID of the power meter is written into D0, and the parameter index is written into D1. If users want to write a value in a register, the low byte is in front of the high byte. For example, if the salve ID of the power meter is 5, the value written into D0 is 16#0500. The value stored in D100 is read in the same way.


NETWORK 1
M0
Station address
16#0500
MOV
S
D
D0
Function code
16#0900
D1
TO
Em
m1
m2
m3
n
D10
1
1
21
Execution type 1
NETWORK 2
M1
16#2900
2
NETWORK 3
M3
16#8900
3
NETWORK 4
M4
16#x900
4
NETWORK 5
M5
16#0100
5

8.8 Error Flags

The error flags and the UD Link statuses are stored in data registers. Users can modify the input device range by themselves.



Data register	Description
D2	Error code
D3	Hardware failure
D4	An error occurs when the communication protocol for exchanging data through COM1 is UD Link.
D5	An error occurs when the communication protocol for exchanging data through COM2 is UD Link.
D6	An error occurs when the communication protocol for exchanging data through COM1 is Modbus.
D7	An error occurs when the communication protocol for exchanging data through COM2 is Modbus.
D8	An error occurs when data is exchanged through COM1.
D9	An error occurs when data is exchanged through COM12
D10	Internal communication error
D11	The group which is triggered when the communication protocol for exchanging data through COM1 is Modbus
D12	The group which is triggered when the communication protocol for exchanging data through COM2 is Modbus
D13	The command which is executed when the communication protocol for exchanging data through COM1 is UD Link
D14	The command which is executed when the communication protocol for exchanging data through COM2 is UD Link
D15	The packet which is sent/received when the communication protocol for exchanging data through COM1 is UD Link
D16	The packet which is sent/received when the communication protocol for exchanging data through COM2 is UD Link
D17	Reserved
D18	Reserved
D19	Reserved

Content of the error flags:

D0

Error code	Description
0x0001	Hardware failure
0x0002	An error occurs when the communication protocol for exchanging data through a communication port is UD Link.
0x0004	An error occurs when data is exchanged through a communication port.
0x0008	An error occurs when the communication protocol for exchanging data through a communication port is Modbus.
0x0010	AH10SCM-5A is restored to the factory setting.
0x0020	Internal communication error

D1

Bit	15~4	3	2	1	0
Description	Reserved	The voltage is low.	The SRAM is damaged.	The GPIO is damaged.	The flash memory is damaged.

D2 and D3

Bit	3	2	1	0
Description	The data received is not the same as the data which should be received.	The packet is edited incorrectly.	The command number can not be found.	The group number can not be found.
Bit	7	6	5	4
Description	The data received is more than the data expected to be received.	The data received is insufficient. The data comparison can not be performed.	Reserved	Checksum error
Bit	11	10	9	8
Description	Reserved	Reserved	Reserved	The group list downloaded to AH10SCM-5A is incomplete.
Bit	15	14	13	12
Description	Reserved	Reserved	The number of data which will be written exceeds the device range.	The number of data which will be read exceeds the device range.

D4 and D5

Error code	Name	Description
0x0001	Illegal function	The function code is not supported.
0x0002	Illegal data address	The address is not supported.
0x0003	Illegal data value	The data value is not supported.
0x0004	Slave device failure	The salve fails.
0x0005	Transform failure	The value is transformed incorrectly.

D6, D7, and D8

Bit	3	2	1	0
Description	Communication timeout error	Buffer overrun	Parity check error	Framing error
Bit	7	6	5	4
Description	Reserved	Internal communication error	Internal communication timeout	Checksum error
Bit	11	10	9	8
Description	Reserved		The buffer zone in which packets received are recorded overflows.	The buffer zone in which packets sent are recorded overflows.
Bit	15	14	13	12
Description	Reserved			

Chapter 9 Network Module AH10EN-5A

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9.1 Introduction

AH10EN-5A is an AH500 series Ethernet module. The data in an AH500 series CPU module can be transmitted to a remote device through Ethernet. Besides, the CPU module can control the remote device through ISPSoft, and a program can be downloaded to the CPU module through ISPSoft.

9.1.1 Functions

- There are two Ethernet ports. They can automatically detect whether the transmission speed is 10 Mbps or 100 Mbps.
- Auto-MDI/MDIX
- It supports the Modbus TCP protocol. (It supports a master mode and a slave mode simultaneously.)
- Sending emails
- It supports SNMPv1 and SNMPv2.
- It automatically adjusts the real-time clock in an AH500 series CPU module through the Network Time Protocol (NTP).
- Point-to-point data exchange

9.1.2 Specifications

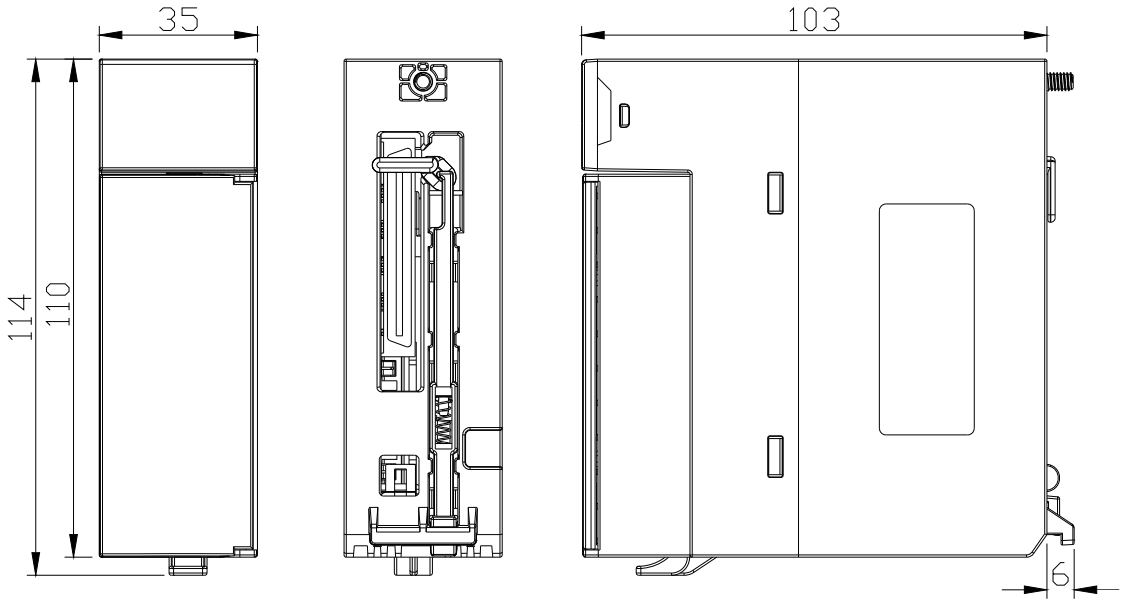
- **Network interface**

Item	Specifications
Connector type	RJ-45 with auto-MDI/MDIX
Transmission interface	802.3 and 802.3u
Transmission cable	Category 5e cable The maximum length is 100 meters.
Transmission speed	10/100 Mbps auto-detection
Communication protocol	ICMP, IP, TCP, UDP, DHCP, NTP, Modbus TCP, HTTP, SNMP, and SMTP

- **Electrical specifications**

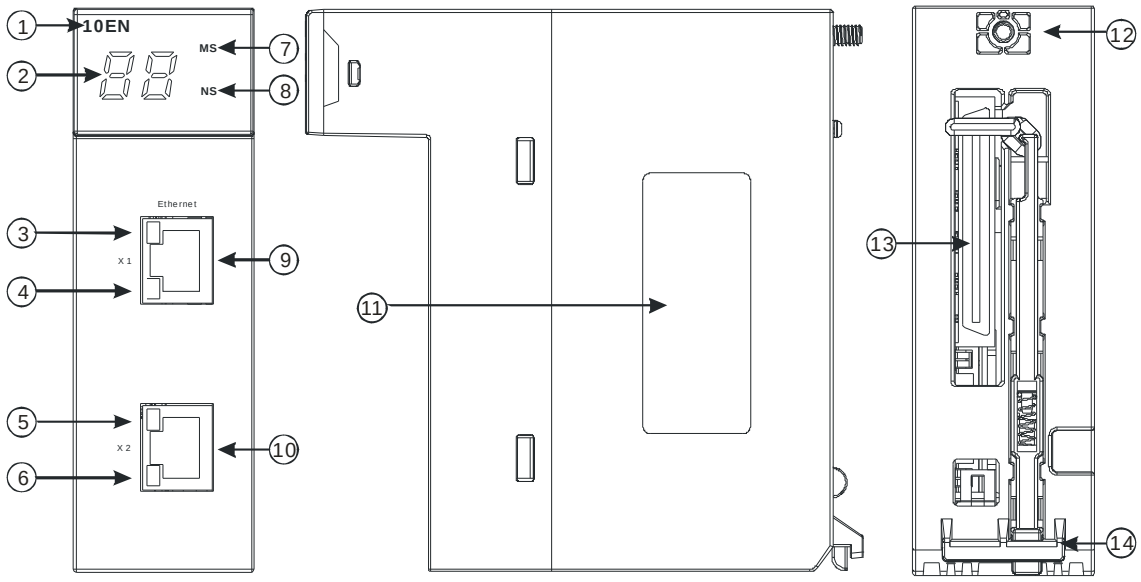
Item	Specifications
Supply voltage	5 V DC
Electric energy consumption	1.5 W
Insulation voltage	2,500 V DC
Weight	Approximately 139 g

9.1.3 Dimensions



Unit: mm

9.1.4 Profile

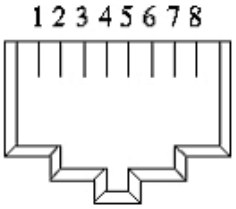


Number	Name	Description
1	Model name	Model name of the module
2	Seven-segment display	Display
3	LINK LED indicator	LINK LED indicator for RJ45 port 1
4	ACK LED indicator	ACK LED indicator for RJ45 port 1
5	LINK LED indicator	LINK LED indicator for RJ45 port 2
6	ACK LED indicator	ACK LED indicator for RJ45 port 2
7	NS LED indicator	LED indicator

Number	Name	Description
8	MS LED indicator	LED indicator
9	RJ45 port 1	RJ45 port 1
10	RJ45 port 2	RJ45 port 2
11	Label	Nameplate
12	Set screw	Fixing the module
13	Connector	Connecting the module and a backplane
14	Projection	Fixing the module

9.1.5 RJ-45 Port

Pin	Definition	Description
1	Tx+	Transmitting data +
2	Tx-	Transmitting data -
3	Rx+	Receiving data +
4	--	N/C
5	--	N/C
6	Rx-	Receiving data -
7	--	N/C
8	--	N/C



9.2 Installation and Wiring

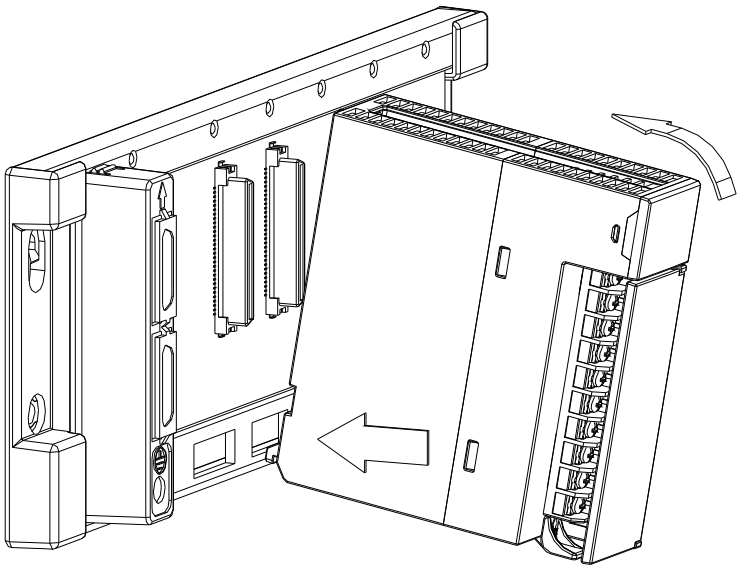
This section introduces the installation of AH10EN-5A, and the connection of AH10EN-5A to the network.

9.2.1 Installation

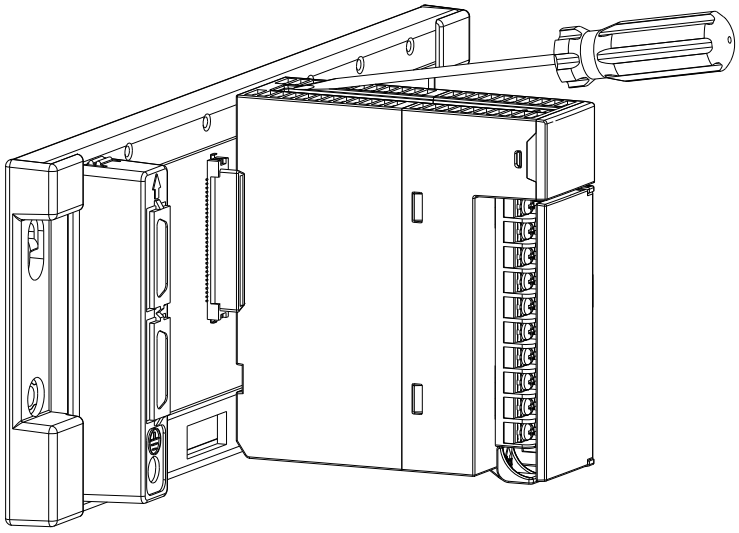
■ **Installing AH10EN-5A on a main backplane:**

Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighen the the screw, as illustrated below.

1. Insert the projection under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.



3. Tighten the screw on the module.



9.2.2 Connecting to the Network

After an AH500 series CPU module is set through HWCONFIG in ISPSoft, AH10EN-5A can carry out communication. The basic setting of the CPU module is accomplished through the RS-232/USB/Ethernet port. After IP addresses and subnet masks are assigned to AH10EN-5A, and a network cable is connected to AH10EN-5A, AH10EN-5A can carry out the communication. Users can choose a Cat 5e twisted pair cable as the network cable, and does not need a jumper wire.

AH10EN-5A is equipped with two RJ45 ports. The ports function as a switching hub that connects network segments. If users want to use these ports, they must assign a single IP address. If AH10EN-5A is connected to two different networks, the users must disable the switching hub function through HWCONFIG, and assign two IP addresses and two subnet masks to AH10EN-5A so that AH10EN-5A connects to a wide area network (WAN) and a local area network (LAN).

9.3 Registers

There are input registers, output registers, and control registers in AH10EN-5A. The status of AH10EN-5A is stored in an input register, functions are triggered by the values in output registers, and parameters related to communication are stored in control registers. Users can set input devices and output devices in a CPU module which correspond to the input registers and the output registers in AH10EN-5A through HWCONFIG in ISPSoft. Besides, the users can read data from a control register by the instruction FROM, and write data into a control register by the instruction TO. The functions of the registers are described below.

9.3.1 Functions of the Input Registers

Number		Attribute	Register name	Description
HW	LW			
-	#0	R	Status of the product	Displaying the status of the system 0: The system is normal.
-	#1	R	Version of the system	The version of the system is represented by a hexadecimal value. For example, if the version of the software is 1.02, it is represented by 16#1020.
-	#2	R	Status of port 1	Displaying the status of port 1
-	#3	R	Status of port 2	Displaying the status of port 2
-	#4	R	Reserved	
-	#5	R	Reserved	
-	#6	R	Statuses of the Modbus TCP clients	Number of Modbus TCP clients which are connected

Number		Attribute	Register name	Description
HW	LW			
-	#7	R	Statuses of the Modbus TCP servers	Number of Modbus TCP servers which are connected
-	#8	R	Reserved	
-	#9	R	Reserved	
-	#10	R	Reserved	
-	#11	R	Statuses of the TCP connections	Number of TCP connections
-	#12	R	Status of transmitting data 1~data 16	Every bit represents a remote device. 0: The data exchange is executed successfully. 1: The data exchange is not executed successfully.
-	#13	R	Status of transmitting data 17~data 32	Every bit represents a remote device. 0: The data exchange is executed successfully. 1: The data exchange is not executed successfully.
-	#14	R	Status of transmitting data 33~data 48	Every bit represents a remote device. 0: The data exchange is executed successfully. 1: The data exchange is not executed successfully.
-	#15	R	Status of transmitting data 49~data 64	Every bit represents a remote device. 0: The data exchange is executed successfully. 1: The data exchange is not executed successfully.
-	#16	R	Time it takes to transmit the input data in AH10EN-5A to the devices in the CPU module	Time it takes to transmit the input data in AH10EN-5A to the devices in the CPU module (Unit: Millisecond)
-	#17	R	Time it takes to transmit the data in the CPU module to the output memory in AH10EN-5A	Time it takes to transmit the data in the CPU module to the output memory in AH10EN-5A
-	#18	R	Time it takes to transmit the data between the registers in AH10EN-5A and the devices in the CPU module.	Time it takes to transmit the data between the input/output registers in AH10EN-5A and the input/output devices in the CPU module (Unit: Millisecond)
-	#19	R	Time it takes to scan the system	Time it takes to scan the system (Unit: Microsecond)

9.3.2 Functions of the Output Registers

Number		Attribute	Register name	Description
HW	LW			
-	#0	R	Reserved	
-	#1	R	Reserved	
-	#2	R	Reserved	
-	#3	R	Reserved	
-	#4	R	Reserved	
-	#5	R	Reserved	
-	#6	R	Reserved	
-	#7	R	Reserved	
-	#8	R	Reserved	
-	#9	R	Reserved	

Number		Attribute	Register name	Description
HW	LW			
-	#10	W	Trigger for the sending of the email	Every bit represents a trigger. 1: The email is sent.
-	#11	W	Mode of the data exchange	0: The execution of the data exchange stops. 1: The data exchange is executed once, and then is not executed. 2: The data exchange is executed continually.
-	#12	W	Triggering the transmission of data 1~data 6	Every bit represents a remote device. 0: The data exchange is not triggered. 1: The data exchange is triggered.
-	#13	W	Triggering the transmission of data 17~data 32	Every bit represents a remote device. 0: The data exchange is not triggered. 1: The data exchange is triggered.
-	#14	W	Triggering the transmission of data 33~data 48	Every bit represents a remote device. 0: The data exchange is not triggered. 1: The data exchange is triggered.
-	#15	W	Triggering the transmission of data 49~data 64	Every bit represents a remote device. 0: The data exchange is not triggered. 1: The data exchange is triggered.
-	#16	R	Reserved	
-	#17	R	Reserved	
-	#18	R	Reserved	
-	#19	R	Reserved	

9.3.3 Functions of the Control Registers

CR number		Attribute	Register name	Description
HW	LW			
-	#0	R	Model code	The model code is a default value. The model code of AH10EN-5A is 16#5881.
-	#1	R	Version of the system	The version of the system is represented by a hexadecimal value. For example, if the version of the software is 1.02, it is represented by 16#1020.
-	#3	R/W	Operation mode	0: A single IP address is assigned, and the two ports function as a switching hub. 1: Two IP addresses are assigned, and the two ports operate individually.
#5	#4	R/W	IP address of port 1	IP address of port 1
#7	#6	R/W	Subnet mask of port 1	Subnet mask of port 1
#9	#8	R/W	Gateway address of port 1	Gateway address of port 1
-	#10	R/W	Assigning an IP address to port 1 by a DHCP server	0: Static IP address 1: An IP address is assigned by a DHCP server.
-	#11	R/W	Triggering the setting of the IP parameters for port 1	0: The assignment of an IP address is complete. 1: The setting of the IP parameters (in CR#4~CR#10) for port 1 is triggered.
-	#12	R/W	Status of assigning an IP address to port 1	0: The assignment of an IP address is complete. 1: An IP address is being assigned. 2: The assignment of an IP address by a DHCP server has not been complete. 3: The IP parameters are incorrect.

CR number		Attribute	Register name	Description
HW	LW			
#15	#14	R/W	IP address of port 2	IP address of port 2
#17	#16	R/W	Subnet mask of port 2	Subnet mask of port 2
-	#20	R/W	Assigning an IP address to port 2 by a DHCP server	0: Static IP address 1: An IP address is assigned by a DHCP server.
-	#21	R/W	Triggering the setting of the IP parameters for port 2	0: The assignment of an IP address is complete. 1: The setting of the IP parameters (in CR#14~CR#20) for port 2 is triggered.
-	#22	R/W	Status of assigning an IP address to port 2	0: The assignment of an IP address is complete. 1: An IP address is being assigned. 2: The assignment of an IP address by a DHCP server has not been complete. 3: The IP parameters are incorrect.
#47	#23		Reserved	
-	#48	R/W	Execution state of email 1	Execution state of email 1
-	#49	R/W	Execution state of email 2	Execution state of email 2
-	#50	R/W	Execution state of email 3	Execution state of email 3
-	#51	R/W	Execution state of email 4	Execution state of email 4
-	#52	R/W	Execution state of email 5	Execution state of email 5
-	#53	R/W	Execution state of email 6	Execution state of email 6
-	#54	R/W	Execution state of email 7	Execution state of email 7
-	#55	R/W	Execution state of email 8	Execution state of email 8
The definitions of the symbols: R: Users can read the data from the register by means of the instruction FROM. W: Users can write the data into the register by means of the instruction TO.				

- **Basic setting and functions**
  - CR#0: The value in CR#0 is a model code. Users can read the model code by means of a program to judge whether the module exists.
  - CR#1: The value in CR#1 represents the version of the system.
- **Email functions**
  - CR#48~CR#55: Please refer to the following table.

Value in the control register	Execution state of the email
0	The email is not sent.
1	The email is being processed.
2	The email is sent successfully.
3~9	Reserved
10	AH10EN-5A can not connect to an SMTP server.
11	The email address of a receiver is incorrect.
12	An error occurs when AH10EN-5A communicates with an SMTP server.
13~255	Reserved

- **Network functions**
  - CR#10: If the value in CR#10 is 0, a static IP address is used. If the value in CR#10 is 1, a DHCP server assigns an IP address. (A dynamic IP address is used.)
  - CR#4~CR#5: The IP address of AH10EN-5A is composed of the values in CR#4 and CR#5. The values in CR#4 and CR#5 are hexadecimal values. If a dynamic IP address is used, users can read data from CR#4 and CR#5, but they can not write data into CR#4 and CR#5.

    Example: If the IP address is 192.168.0.2, 16#0002 is written into CR#4, and 16#C0A8 is written into CR#5. (K192=16#C0, K168=16#A8, K0=16#00, and K2=16#02.)
  - CR#6~CR#7: The subnet mask of AH10EN-5A is composed of the values in CR#6 and CR#7. The values in CR#6 and CR#7 are hexadecimal values. If a dynamic IP address is used, users can read data from CR#6 and CR#7, but they can not write data into CR#6 and CR#7.

    Example: If the subnet mask is 255.255.255.0, 16#FF00 is written into CR#6, and 16#FFFF is written into CR#7.
  - CR#8~CR#9: The gateway address of AH10EN-5A is composed of the values in CR#8 and CR#9. The values in CR#8 and CR#9 are hexadecimal values. If a dynamic IP address is used, users can read data from CR#8 and CR#9, but they can not write data into CR#8 and CR#9.
  - CR#11: Triggering the setting of the IP parameters for port 1

    0: The assignment of an IP address is complete.

    1: The setting of the IP parameters (in CR#4~CR#10) for port 1 is triggered.
  - CR#12: Status of assigning an IP address to port 1

    0: The assignment of an IP address is complete.

    1: An IP address is being assigned.

    2: The assignment of an IP address by a DHCP server has not been complete.

    3: The IP parameters are incorrect.

9.3.4 Introduction of the Related Instructions

After AH10EN-5A is installed, users need to write a program to control the related functions of AH10EN-5A. The users can read data from a control register in AH10EN-5A by means of the instruction FROM, and write data into a control register in AH10EN-5A by means of the instruction TO.

API	Instruction code			Operand	Function
1400	D	FROM	P	$m_1, m_2, m_3, D_1, D_2, n$	Reading the data from the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m_1	●	●			●	●	●	●	●				●	○	○		
m_2	●	●			●	●	●	●	●				●	○	○		
m_3	●	●			●	●	●	●	●				●	○	○		
D_1	●	●			●	●	●	●	●				●				
D_2	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:

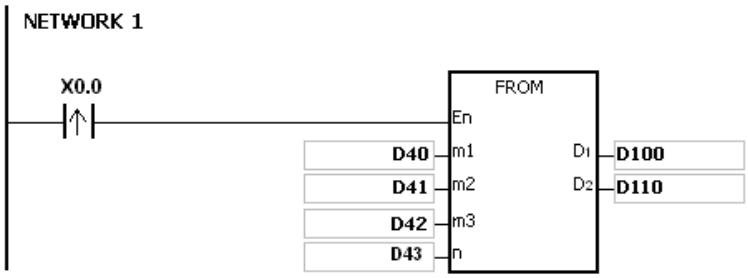
m_1	:	Rack code	Word/Double word
m_2	:	Slot code	Word/Double word
m_3	:	Control register number	Word/Double word
D_1	:	Device in which the data is stored	Word/Double word
D_2	:	Device in which the error code is stored	Word/Double word
n	:	Data length	Word/Double word

Explanation:

1. Users can use this instruction to read data from a control register in a network module into an AH500 series PLC.
2. The operand m_1 should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand m_2 should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
4. The operand m_3 specifies the control register number.
5. When the instruction FROM is executed, D_2 is set to 0. When an error occurs, D_2 is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be in the range of 1 to 256, and the operand **n** used in the 32-bit instruction should be in the range of 1 to 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. Please refer to the regulation of the operands in the instruction TO for more information about the numbering of network modules.

Example:

Suppose the first special module at the right side of the CPU module is AH10EN-5A. When X0.0 is switched from OFF to ON, the instruction FROM is executed. The operation mode stored in CR#3 in AH10EN-5A is read into D100. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.



The use of the parameters:

- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The operation mode is stored in CR#3. Therefore, the control register number stored in D42 is 16#0003.
- Owing to the fact that the operation mode occupies one register, the value in D43 is 1.
- The data which is read from CR#3 is stored in D100.

Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If $\mathbf{D_1}$~$\mathbf{D_1}$+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction FROM decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

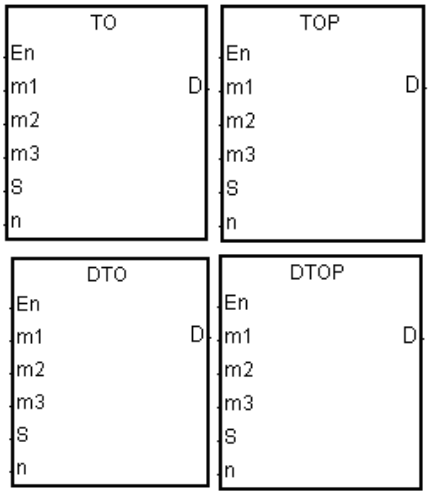
Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

API	Instruction code			Operand	Function
1401	D	TO	P	**m_1, m_2, m_3, S, D, n**	Writing the data into the control register in the special module

Device	X	Y	M	S	T	C	HC	D	L	SM	SR	E	PR	K	16#	"$"	DF
m_1	●	●			●	●	●	●	●				●	○	○		
m_2	●	●			●	●	●	●	●				●	○	○		
m_3	●	●			●	●	●	●	●				●	○	○		
S	●	●			●	●	●	●	●				●	○	○		
D	●	●			●	●	●	●	●				●				
n	●	●			●	●	●	●	●				●	○	○		

Pulse instruction	16-bit instruction (13 steps)	32-bit instruction (13 steps)
AH500	AH500	AH500

Symbol:



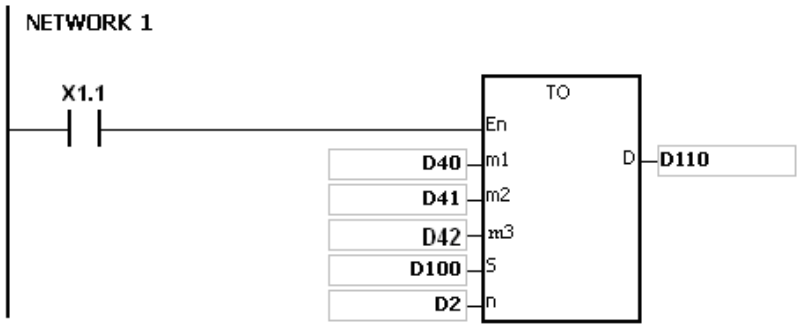
m_1	:	Rack code	Word/Double word
m_2	:	Slot code	Word/Double word
m_3	:	Control register number	Word/Double word
S	:	Data which is written into the control register	Word/Double word
D	:	Device in which the error code is stored	Word/Double word
n	:	Data length	Word/Double word

Explanation:

1. Users can use this instruction to write data in an AH500 series PLC into a control register in a network module.
2. The operand **m_1** should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
3. The operand **m_2** should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
4. The operand **m_3** specifies the control register number.
5. When the instruction TO is executed, **D** is set to 0. When an error occurs, **D** is not set to 0. Please refer to the additional remark below for more information about the error codes.
6. The operand **n** used in the 16-bit instruction should be in the range of 1 to 256, and the operand **n** used in the 32-bit instruction should be in the range of 1 to 128.
7. Only the 32-bit instructions can use the 32-bit counter.
8. When **S** is a decimal value or a hexadecimal value, **n** decimal values or **n** hexadecimal values are transmitted to the I/O module. Suppose **S** is 16#0001 and **n** is 3. Three 16#0001s are transmitted to the I/O module.

Example:

Suppose the first special module at the right side of the CPU module is AH10EN-5A. When X1.1 is switched from OFF to ON, the instruction TO is executed. The value stored in CR#3 in AH10EN-5A changes from 0 to 1. Owing to the fact that no error occurs, the code stored in D110 is 16#0000.

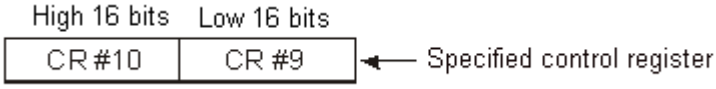


The use of the parameters:

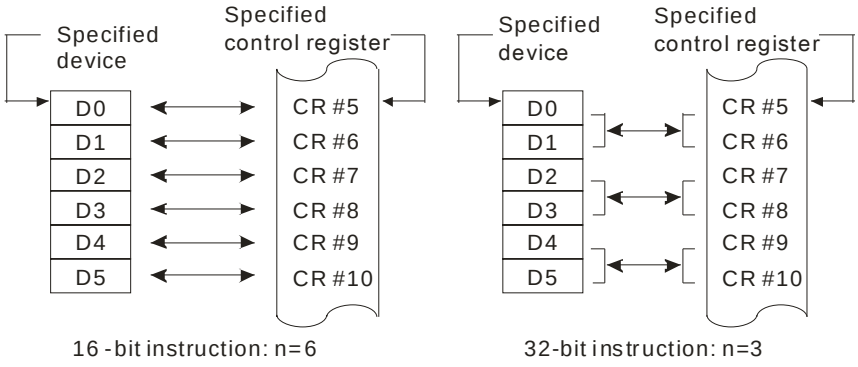
- The module is placed on the main rack. Therefore, the rack code stored in D40 is 16#0001.
- The module is inserted in the first slot. Therefore, the slot code stored in D41 is 16#0000.
- The operation mode is stored in CR#3. Therefore, the control register number stored in D42 is 16#0003.
- Owing to the fact that the operation mode occupies one register, the value in D2 is 1.
- The data which is written into CR#3 is stored in D100. Therefore, the value in D100 is 16#0001.

The regulation of the operands in the instruction:

- The operand $\mathbf{m_1}$ specifies the rack code. It should be in the range of 1 to 8. 1 represents a main rack, and 2~8 represent extension racks.
- The operand $\mathbf{m_2}$ specifies the slot code. It should be in the range of 0 to 11. If the rack code is 1, the slot code should be in the range of 0 to 11. If the rack code is in the range of 2 to 8, the slot code should be in the range of 0 to 7.
- The operand $\mathbf{m_3}$ specifies the control register number. The 16-bit memories built in the network modules are called the control registers. The control register numbers are decimal numbers #0~#N, and the number of control registers varies with the module. The operating conditions of the network module and the setting values are stored in the control registers.
- At most 68 special modules can be placed on the rack, and they do not occupy inputs/outputs.
- If the instruction FROM/TO is used, one control register is taken as a unit for the reading/writing of the data. If the instruction DFROM/DTO is used, two control registers are taken as a unit for the reading/writing of the data.



- The **n** which is 2 in the 16-bit instruction has the same meaning as the **n** which is 1 in the 32-bit instruction.



Additional remark:

1. If the values in $\mathbf{m_1}$ and $\mathbf{m_2}$ exceed the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.
2. If **S**~**S**+**n**-1 exceed the device range, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#2003.

3. If the value in **n** exceeds the range, the operation error occurs, the instruction is not executed, SM0 is ON, and the error code in SR0 is 16#200B.
4. Due to the fact that the use of the instruction TO decreases the execution efficiency of the CPU module and that of the I/O module, users should use it less often.
5. The descriptions of the error codes:

Error code	Description
16#2003	Please refer to point 1 and point 2 in the additional remark.
16#200B	Please refer to point 3 in the additional remark.
16#1400	An error occurs when the data is accessed through the auxiliary processor.
16#1401	An error occurs when the data in the I/O module is accessed.
16#1402	The arrangement of the I/O modules is not consistent with the module table.
16#1407	A communication error occurs when the data is accessed through the auxiliary processor.

9.4 Setting AH10EN-5A through ISPSoft

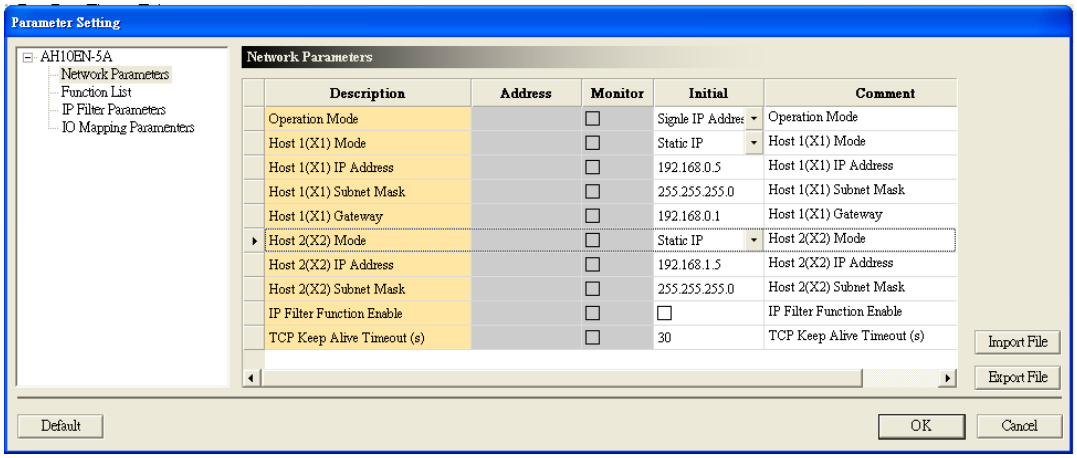
This section introduces the setting of AH10EN-5A through ISPSoft. There are three configurations in ISPSoft.

1. Hardware configuration: Setting the basic parameters
2. Network configuration: Setting the Ether Link
3. Intelligent module configuration: Setting the exclusive parameters

Please refer to ISPSoft User Manual for more information about HWCONFIG and NWCONFIG.

9.4.1 HWCONFIG—Network Parameters

All network devices which will be connected to networks need Internet Protocol addresses (IP addresses). The IP addresses are like numbers, and are used to identify the identities of these network devices on the networks.



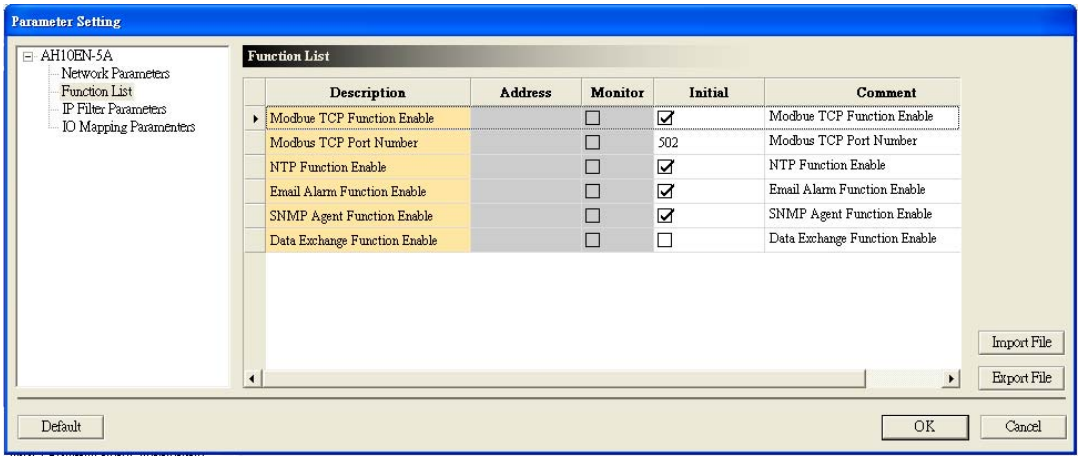
- **Operation mode**
  Users can select an operation mode of AH10EN-5A. They can assign a single IP address to AH10EN-5A and make AH10EN-5A support a switching hub, or they can assign two IP addresses to AH10EN-5A and make the two ports operate individually.
- **IP address assignment**
  There are two ways to assign IP addresses.
  Static IP address: An IP address is manually assigned.

DHCP: An IP address is assigned by a server. There must be a server existing on a local area network.

Option	Description
Static IP address	Users assign an IP address, a subnet mask, and a default gateway.
DHCP	A DHCP server assigns an IP address, a subnet mask, and a gateway.

- **IP address**
  An IP address is the address of a device on a network. Every device connected to a network needs an IP address. If a wrong IP address is used, the device can not connect to a network, even other devices can not connect to the network. Please contact a network administrator to get more information about assigning an IP address. The default IP address of AH10EN-5A is 192.168.0.5.
- **Subnet mask**
  A subnet mask is an important parameter for setting a subnet, and is used to judge whether the IP address of a destination device and the IP address of a local device are in the same subnet. If the IP address of a destination device and the IP address of a local device are not in the same subnet, the local device will send a packet to a gateway, and the gateway will send the packet to another subnet. If the setting is incorrect, a destination device can not communicate with AH10EN-5A normally. Users can judge whether the IP address of a destination device and the IP address of a local device are in the same subnet by performing a bitwise AND operation between the IP address of the local device and the subnet mask, and a bitwise AND operation between the IP address of the destination device and the subnet mask. If the two values are the same, the IP address of the destination device and the IP address of the local device are in the same subnet. The default subnet mask of AH10EN-5A is 255.255.255.0.
- **Default gateway**
  A gateway is a network point that acts as an entrance to another network. For example, in order to connect a local area network and a wide area network, a gateway is needed. The IP address that a gateway uses and the IP address of AH10EN-5A must be in the same subnet. The default gateway of AH10EN-5A is 192.168.1.1.
- **IP filter**
  AH10EN-5A provides a firewall service, and adopts an IP filter. To prevent errors from occurring, an IP filter is used to limit network connections. Only devices whose IP addresses are within the range set by users can connect to AH10EN-5A, and other devices whose IP addresses are not within the range can not connect to AH10EN-5A. After the IP filter function is enabled, IP addresses are filtered according to data which are set.
- **TCP keepalive period**
  The TCP keepalive period by default is set to 30 seconds.

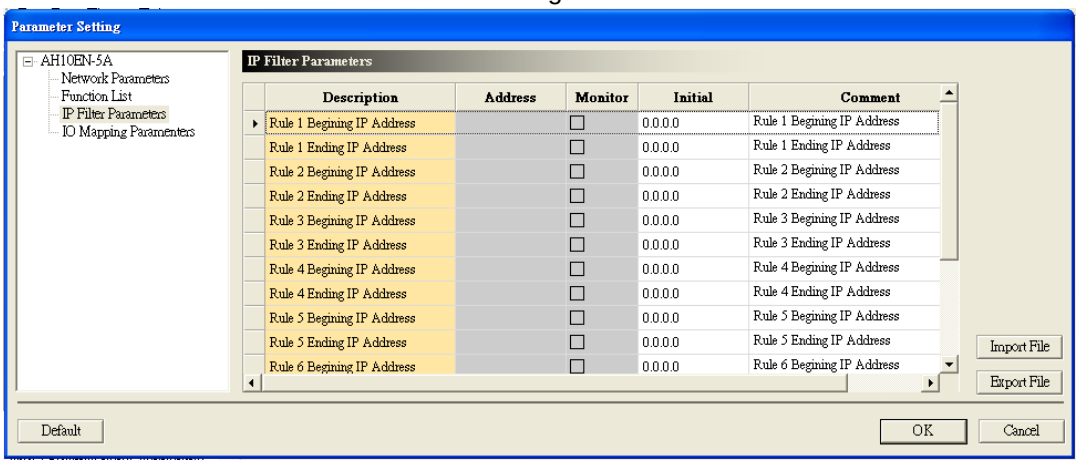
9.4.2 HWCONFIG—Function List



- **Enabling the MODBUS TCP function**
  Enabling or disabling the Modbus TCP protocol.
- **Modbus TCP port number**
  Users can set a Modbus TCP port number. The default value is 502.
- **Enabling the time correction function**
  AH10EN-5A synchronizes the real-time clock in an AH500 series CPU module to a server on a network through the Network Time Protocol (NTP). To ensure that time is correct, the time is corrected every specific period of time
- **Enabling the email alarm function**
  After the email alarm function is enabled, users can trigger the sending of an email through a program.
- **Enabling the SNMP agent function**
  After the SNMP agent function is enabled, users can access a device in a CPU module
- **Enabling the data exchange function**
  After the data exchange function is enabled, users can set a data exchange.

9.4.3 HWCONFIG—IP Filter Parameters

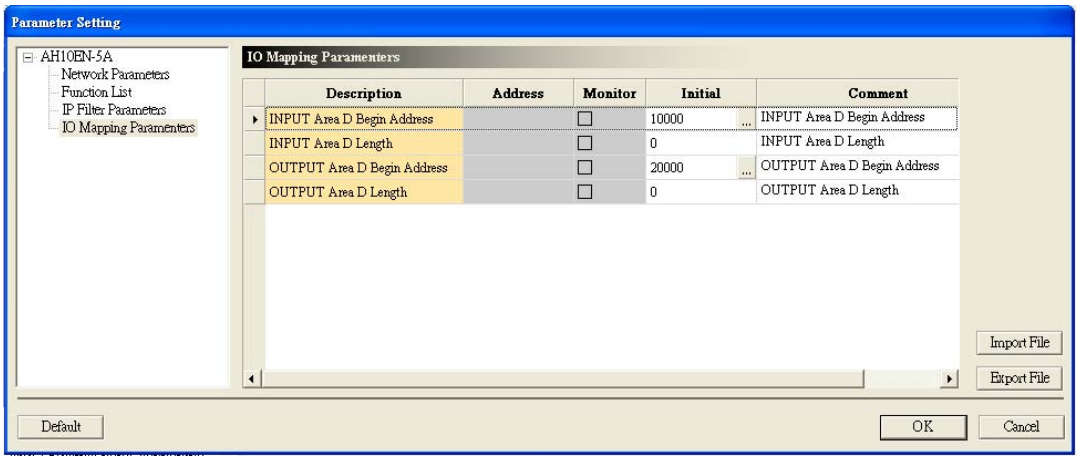
To prevent errors from occurring, an IP filter is used to limit network connections. Only devices whose IP addresses are within the range set by users can connect to AH10EN-5A, and other devices whose IP addresses are not within the range can not connect to AH10EN-5A.



- **Setting an IP filter**
  User can set eight starting IP addresses and eight ending IP addresses.

9.4.4 HWCONFIG—I/O Mapping Parameters

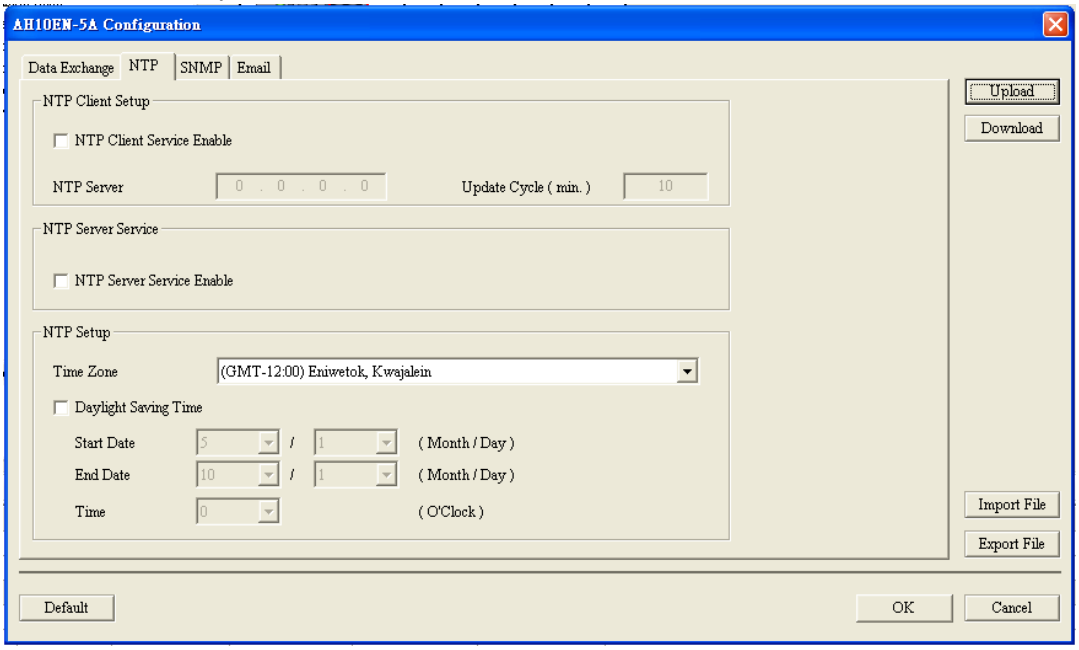
I/O mapping is used to set data registers in a CPU module to which input data is transmitted, or from which data is transmitted.



- **Input data parameters**
  Users can set an initial data register to which input data is transmitted, and the number of data registers. 12288 data registers at most can be used.
- **Output data parameters**
  Users can set an initial data register from which data is transmitted, and the number of data registers. 12288 data registers at most can be used.

9.4.5 Intelligent Module Configuration—NTP

Users can set the parameters related to time correction.



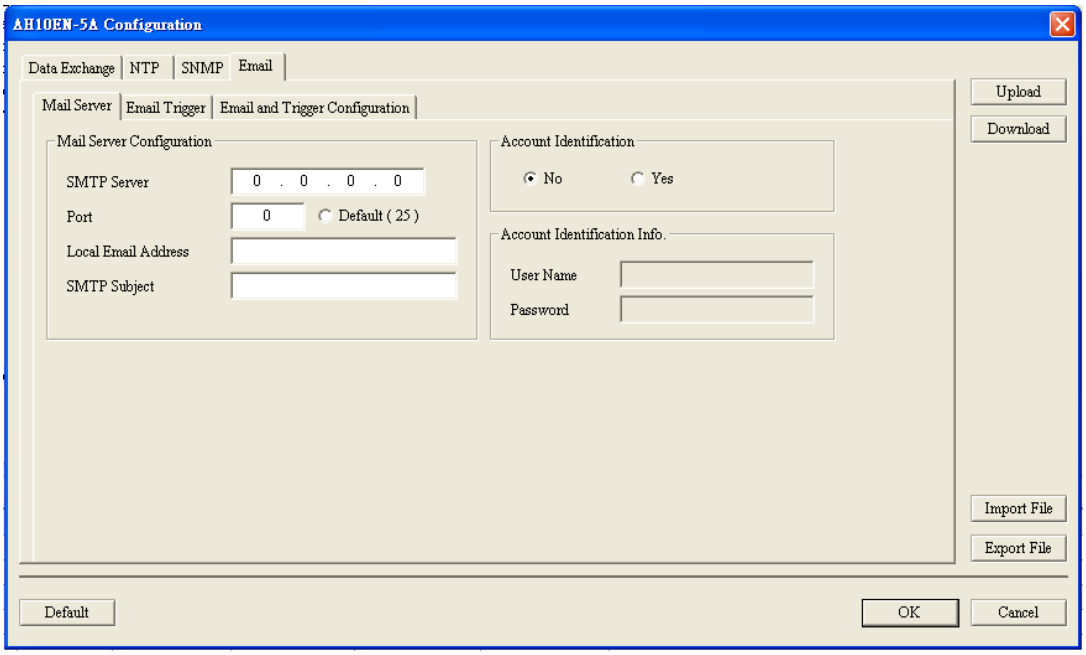
- **Correction cycle**
  AH10EN-5A synchronizes the real-time clock in an AH500 series CPU module to a server on a network through the Network Time Protocol (NTP). To ensure that time is correct, the time is corrected every specific period of time. The default value is 10 minutes. The setting range is from 1 minute to 1440 minutes.
- **Using Daylight saving time**
  Daylight saving time—also summer time—is the practice of adjusting clocks forward one hour near the start of spring and adjusted backward in autumn. The total number of hours in a day in spring is 23. Whether a country uses daylight saving time depends on its policy. Since Taiwan does not use DST, the daylight saving time function is not enabled.
- **Start date, end date, and time when a one-hour shift occurs**
  After the **Daylight Saving Time** checkbox is selected, users can set a start date, an end data, and time when a one-hour shift occurs.
- **NTP server**
  Users can set the IP address of an NTP server. The real-time clock in a CPU module can be synchronized to the NTP server.
- **Time zone**
  The earth is divided into 24 time zones. Each time zone calculates local time in relation to Greenwich Mean Time (GMT). Users can select the city in which their device is located, or specify the time difference between a local time zone and Coordinated Universal Time (UTC).
- **Enabling the NTP server service**
  AH10EN-5A can function as an NTP server. Modules on a network can be synchronized to AH10EN-5A.

9.4.6 Intelligent Module Configuration—Email

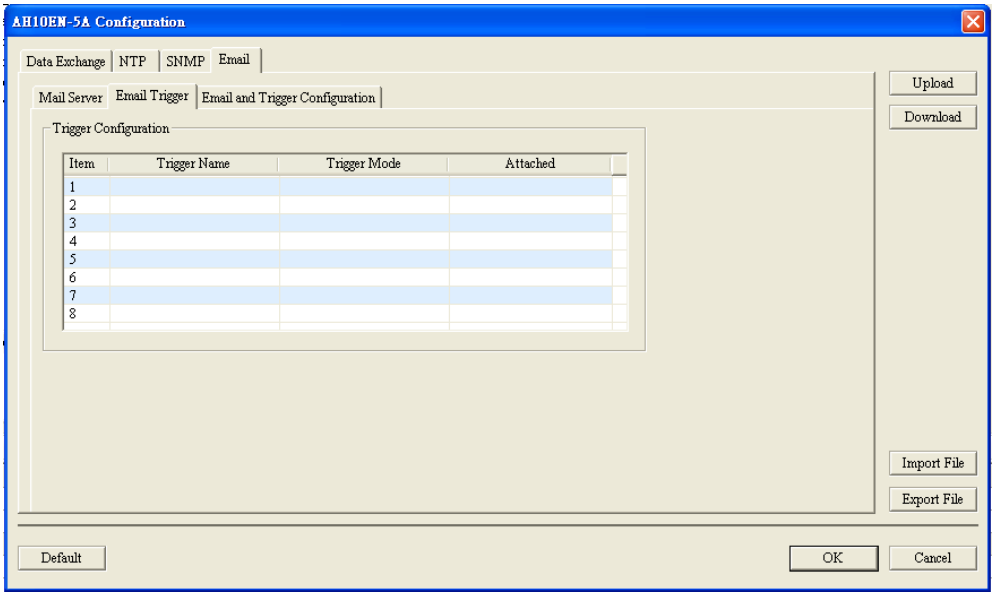
Electronic mail, also known as email, operates across the Internet or other computer networks.

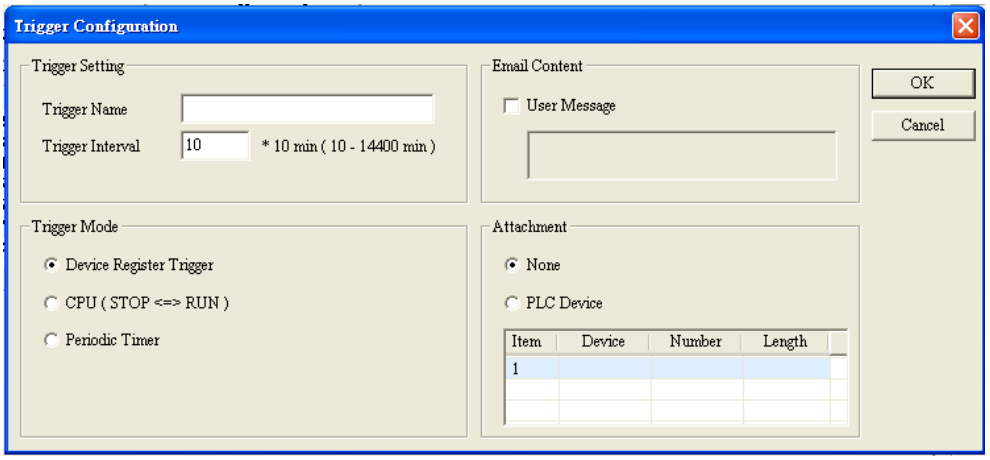
AH10EN-5A is equipped with the function of sending emails. Users can enter a text message related to a description of a status or an error in the **SMTP Subject** box. If a condition of triggering the sending of an email is met, the email will be sent to the users. There are three subtabs in the **Email** tab.

- **Mail server**

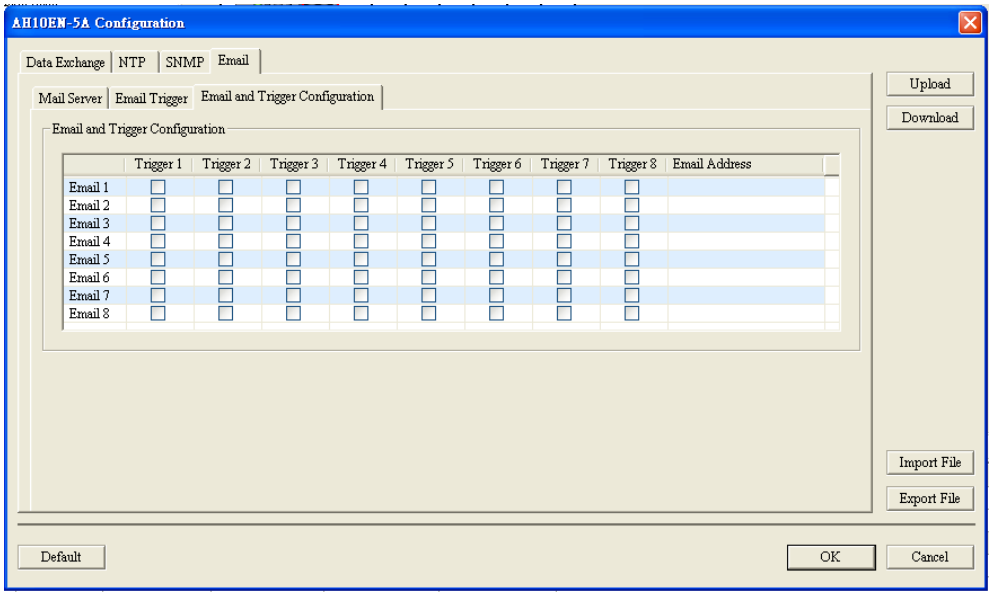


- **SMTP server**
  An email is sent to an SMTP server, and then the SMTP server sends the email to an address which is specified. For example, if an email is going to be sent to Test@delta.com.tw, and the IP address of an SMTP server is 172.16.144.121, the email is sent to the SMTP server, and then the SMTP server sends the email to Test@delta.com.tw.
- **Local email address**
  It is the address of an actual sender. A local email address is composed of 64 English characters at most.
- **Subject of an email**
  Users can enter a text message in the **SMTP Subject** box. The text message will be the subject of an email, and will be sent to a receiver. The subject of an email is composed of 64 English characters at most.
- **Username and password**
  Users can enter a username and a password for authentication.





- **Trigger name**
  If a condition of triggering the sending of an email is met, AH10EN-5A will send the email, and the trigger name will be the subject of the email.
- **Time Interval**
  After a condition of triggering the sending of an email is met, a second email will not be sent within the time interval.
- **Mode of triggering the sending of an email**
  The sending of an email can be triggered by the value in a register, triggered when a CPU module runs, or triggered periodically.
- **User message**
  Users can enter a user message. The message will be the contents of an email.
- **Attachment**
  The present value in a device in a CPU module can be an attachment to an email.



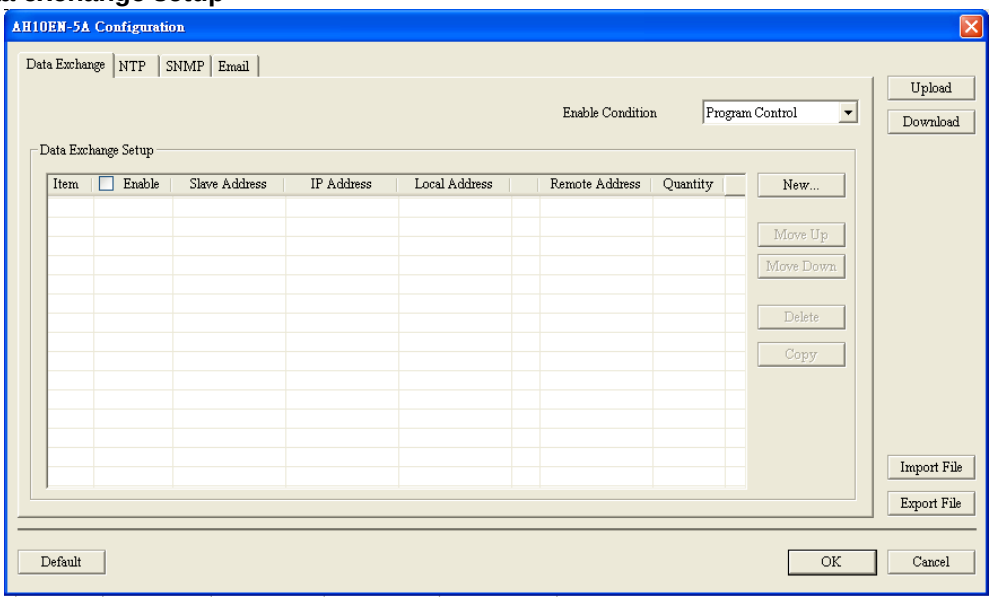
- **Email address and trigger**
  After the setting of email parameters is complete, users have to set email addresses to which emails are sent, and select triggers for the sending of the emails.
- **Email address of a sender**
  The email address of a sender is an address to which an email is sent. (An email address is composed of 63 English characters at most.)

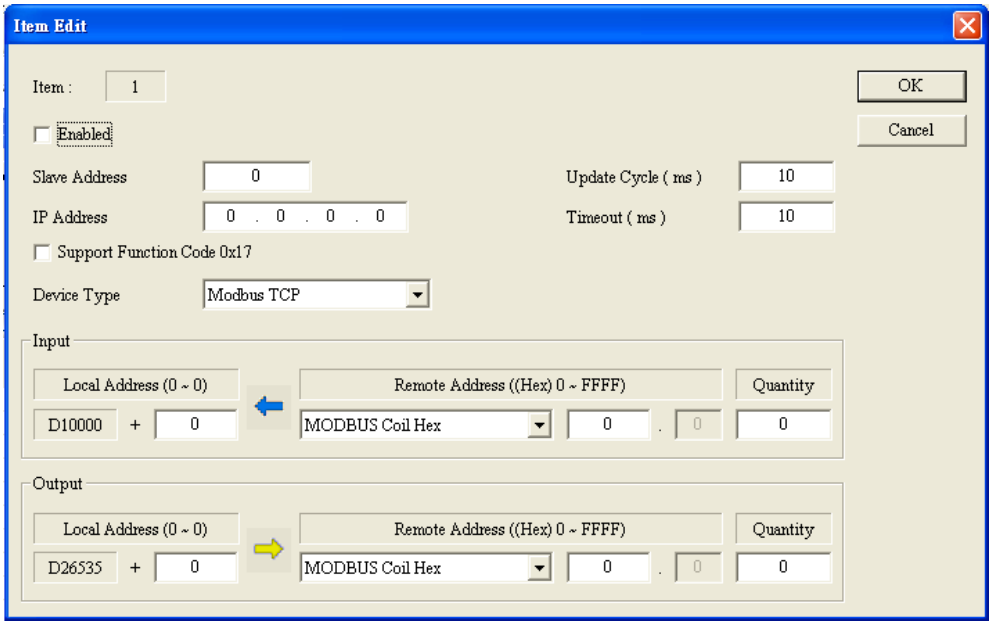
Note: Only if there is a mail server on a network can an email be sent correctly. An email is sent to a mail server, and then the mail server sends the email to an address which is specified.

9.4.7 Intelligent Module Configuration—Data Exchange

CPU modules can exchange the data in devices which are specified through the data exchange function of AH10EN-5A.

- **Data exchange setup**





- **Operation mode**
  The data exchange function can be always enabled, controlled by a program, or enabled when a PLC runs. If the data exchange function is always enabled, AH10EN-A1 will execute the function continually. If the data exchange function is controlled by a program, the function will be controlled by the setting value in an output register. If the data exchange function is enabled when a PLC runs, the status of the PLC will be detected. When the PLC runs, the function is enabled.
- **Station address and IP address**
  Users need to enter the IP address and the station address of a slave station.
- **Initial register in a master station, initial register in a slave station, and number of data**

  Input: Initial reception register in a master station←Initial transmission register in a slave station

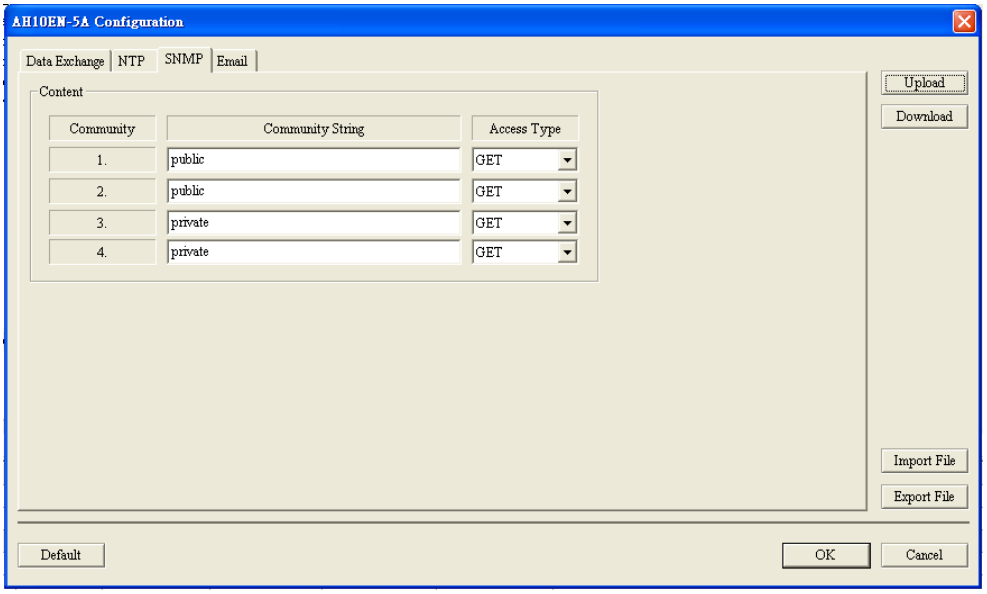
  Output: Initial transmission register in a master station→Initial reception register in a slave station

  Number of data: A slave station can send 100 pieces of data at most and receive 100 pieces of data at most simultaneously.

9.4.8 Intelligent Module Configuration—SNMP

SNMP is used in a network environment to read and control CPU parameters.

- **SNMP**



- **Community string**
  The communities which can be connected to AH10EN-5A
- **Access type**
  Users can select **GET** (reading), or **GET/SET** (reading/writing).

Chapter 10 High-speed Counter Module AH02HC-5A / AH04HC-5A

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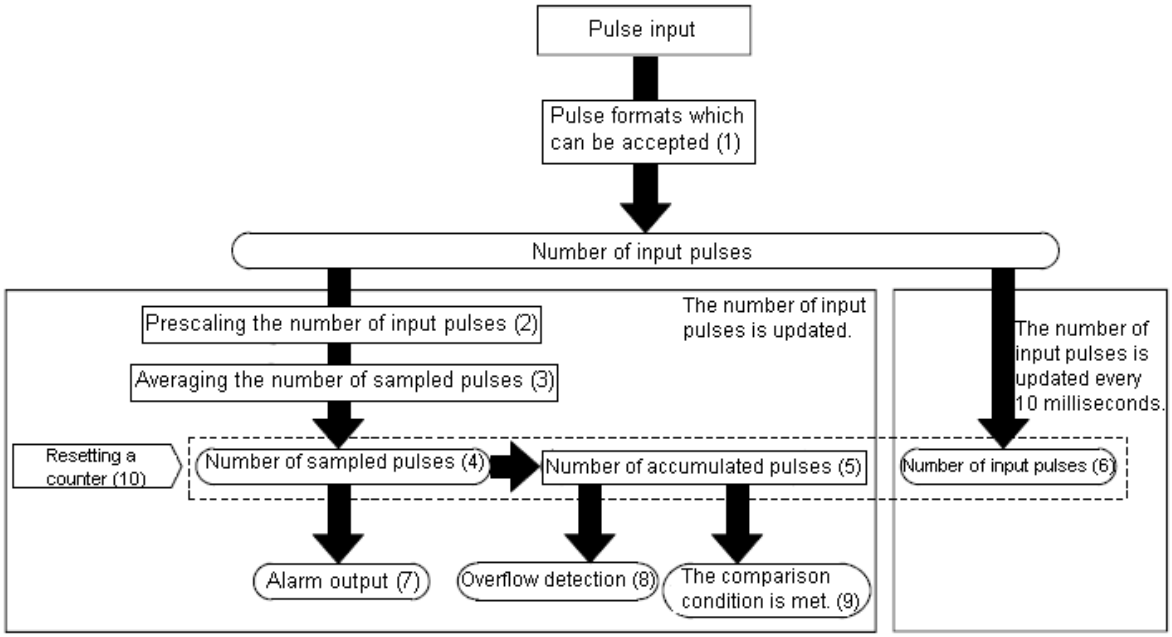
10.1 Introduction

An AH500 series high-speed counter module has several bidirectional high-speed counters. It can update the number of input pulses instantly. It can also cyclically update, prescale, and average the number of sampled pulses. If the number of sampled pulses is monitored, an alarm can be generated. The number of sampled pulses is added to the number of accumulated pulses. Users can detect whether the number of accumulated pulses overflows, and compares the number of accumulated pulses with a value.

- AH02HC-5A: Two bidirectional high-speed counters
- AH04HC-5A: Four bidirectional high-speed counters

10.1.1 Characteristics

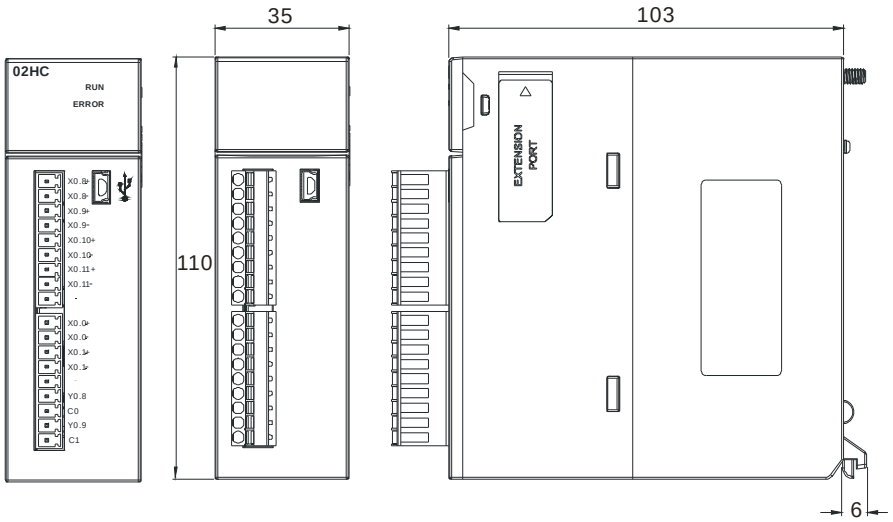

Pulse input
Pulse formats which can be accepted (1)
Number of input pulses
Prescaling the number of input pulses (2)
Averaging the number of sampled pulses (3)
The number of input pulses is updated.
The number of input pulses is updated every 10 milliseconds.
Resetting a counter (10)
Number of sampled pulses (4)
Number of accumulated pulses (5)
Number of input pulses (6)
Alarm output (7)
Overflow detection (8)
The comparison condition is met. (9)

1. Pulse formats which can be accepted
   Single pulse, double pulse, one time the frequency of A/B-phase inputs, and four times the frequency of A/B-phase inputs
2. Prescaling the number of input pulses
   After the number of input pulses is multiply by a certain value, it will become a value which has a specific significance.
3. Averaging the number of sampled pulses
   The number of sampled pulses is divided by the number of cycles set by users.
4. Number of sampled pulses
   The number of pulses sampled during the cycle can be prescaled. If the number of input pulses is not even every time, it can be averaged. The number of sampled pulses is in the range of -200000 to 200000.
5. Number of accumulated pulses
   The number of pulses sampled during every cycle is accumulated. The number of accumulated pulses is in the range of -999999999 to 999999999. The number of pulses sampled during every cycle can be accumulated linearly or circularly.
6. Number of input pulses
   The number of input pulses is updated every 10 milliseconds. The number of input pulses is in the range of -2147483648 to 2147483647.
7. Alarm output
   Users can set an upper-upper limit value, an upper-lower limit value, a lower-upper limit value, and a lower-lower limit value. If the number of sampled pulses is larger than the upper-upper limit value set, or less than the lower-lower limit value set, an alarm will be generated.

8. Detecting the number of accumulated pulses overflows
   If linear accumulation is used, users can detect whether the number of accumulated pulses overflows. If the number of accumulated pulses overflows, the overflow flag will be turned ON.
9. Comparing the number of accumulated pulses with a value
   If the number of accumulated pulses is larger than or equal to the comparison value set, the comparison flag will be turned ON.
10. Resetting a counter
    A counter can be reset by means of software or an external trigger.
    The number of sampled pulses, the number of accumulated pulses, and the number of input pulses can be reset at any time.

10.2 Specifications

10.2.1 Dimensions of AH02HC-5A



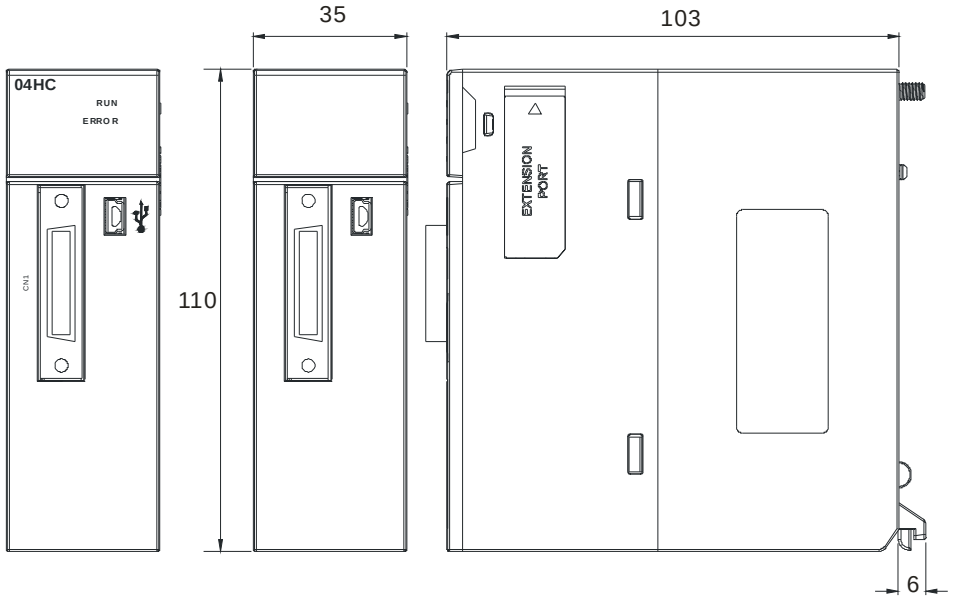
Unit: mm

10.2.2 Specifications for AH02HC-5A

Item		Specifications
Number of channels		2 channels
Input signal	**Input (differential signal)**	Channel 0: X0.8+, X0.8-, X0.9+, and X0.9- Channel 1: X0.10+, X0.10-, X0.11+, and X0.11-
	Pulse format	Pulse/Direction (one phase and one input) Counting up/Counting down (one phase and two inputs) One time the frequency of A/B-phase inputs (two phases and two inputs) Four times the frequency of A/B-phase inputs (two phases and two inputs)
	Signal level	5~24 V DC

Item		Specifications
Specifications	Maximum frequency of counting	The maximum frequency is 200 kHz.
	Range	The number of sampled pulses is in the range of -200000 to 200000. The number of accumulated pulses is in the range of -999999999 to 999999999. The number of input pulses is in the range of -2147483648 to 2147483648.
	Type	General count Circular count
RESET input	Input (differential signal)	CH0: X0.0+ and X0.0- CH1: X0.1+ and X0.1-
	Signal level	5~24 V DC
	Maximum current	15 mA
Comparison output	Output type	Channel 0: The high-speed pulse output Y0.8 is a transistor whose collector is an open collector. Channel 1: The high-speed pulse output Y0.9 is a transistor whose collector is an open collector.
	Signal level	24 V DC
	Maximum current	15 mA

10.2.3 Dimensions of AH04HC-5A



Unit: mm

10.2.4 Specifications for AH04HC-5A

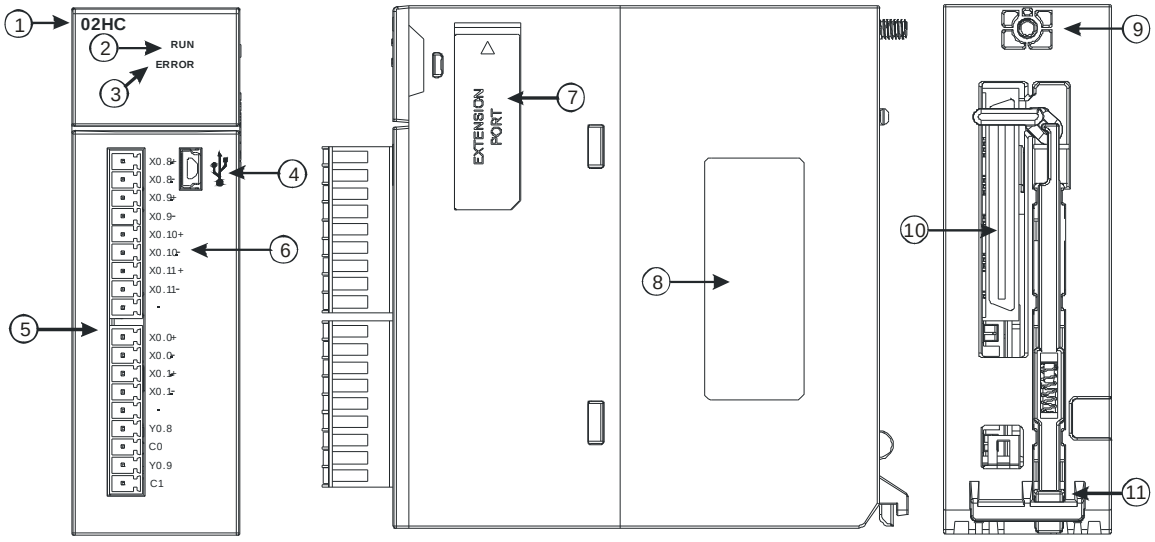
Item	Specifications
Connector	A connector made with great precision is used. It has to be connected to an external terminal module.
Number of channels	4 channels

Item		Specifications
Input signal	**Input (differential signal)**	Channel 0: X0.8+, X0.8-, X0.9+, and X0.9- Channel 1: X0.10+, X0.10-, X0.11+, and X0.11- Channel 2: X0.12+, X0.12-, X0.13+, and X0.13- Channel 3: X0.14+, X0.14-, X0.15+, and X0.15-
	Pulse format	Pulse/Direction (one phase and one input) Counting up/Counting up (one phase and two inputs) One time the frequency of A/B-phase inputs (two phases and two inputs) Four times the frequency of A/B-phase inputs (two phases and two inputs)
	Signal level	5~24 V DC
Specifications	**Maximum frequency of counting**	The maximum frequency is 200 kHz.
	Range	The number of sampled pulses is in the range of -200000 to 200000. The number of accumulated pulses is in the range of -999999999 to 999999999. The number of input pulses is in the range of -2147483648 to 2147483648.
	Type	Linear count Circular count
RESET input	**Input (differential signal)**	CH0: X0.0+ and X0.0- CH1: X0.1+ and X0.1- CH2: X0.2+ and X0.2- CH3: X0.3+ and X0.3-
	Signal level	5~24 V DC
	Maximum current	15 mA
Comparison output	**Output type**	Channel 0: The high-speed pulse output Y0.8 is a transistor whose collector is an open collector. Channel 1: The high-speed pulse output Y0.9 is a transistor whose collector is an open collector. Channel 2: The high-speed pulse output Y0.10 is a transistor whose collector is an open collector. Channel 3: The high-speed pulse output Y0.11 is a transistor whose collector is an open collector.
	Signal level	24 V DC
	Maximum current	15 mA

10.2.5 Functions of AH02HC-5A/AH04HC-5A

Function		Description
Enabling/Disabling a count		1. Users can enable or disable a channel. 2. If unnecessary channels are disabled, the internal operation will become more efficient.
Accumulation counter	Linear count	The number of accumulated pulses is in the range of -999999999 to 999999999. If the number of accumulated pulses is not within the range, the overflow flag will be turned ON.
	Circular count	The number of accumulated pulses is in the range of -999999999 to 0, or in the range of 0 to 999999999.
	Comparison	If the number of accumulated pulses meets the comparison condition set, the comparison flag will be turned ON, and a signal will be output. Users can reset the comparison condition.
Sampling counter	Setting a cycle	Users can change the cycle of updating the number of sampled pulses or the cycle of updating the number of accumulated pulses.
	Averaging the number of sampled pulses	The number of sampled pulses is divided by the number of cycles set by users.
	Prescaling the number of input pulses	The number of input pulses is multiplied by a scale.
	Alarm	If the number of sampled pulses is larger than the upper-upper limit value set, or less than the lower-lower limit value set, an alarm will be generated. If the number of sampled pulses is between the upper-lower limit value set and the lower-upper limit value set, the alarm will stop.
Resetting a counter		The number of pulses received by a channel is reset.

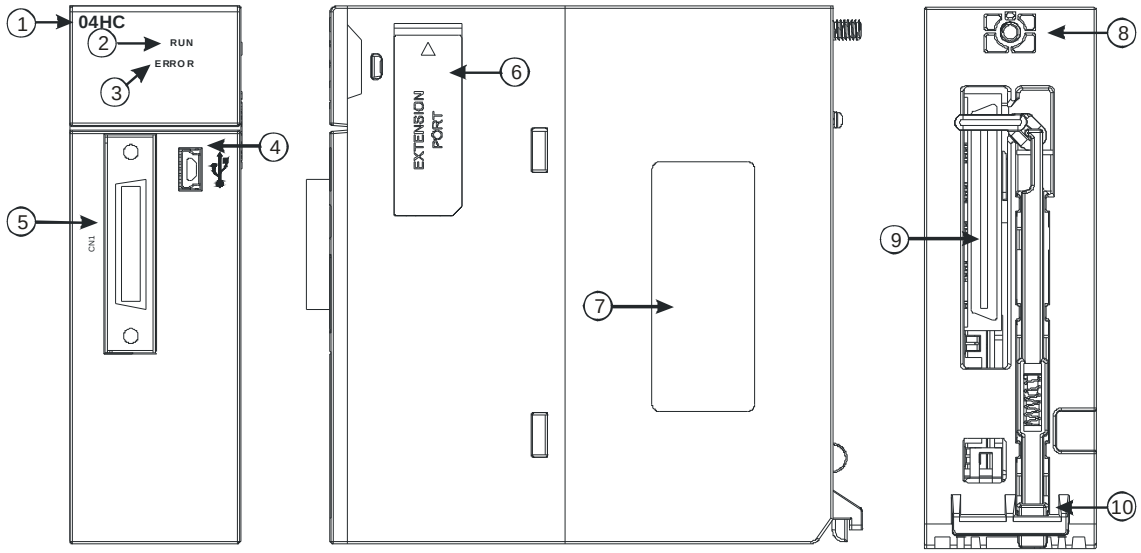
10.2.6 Profile of AH02HC-5A



Number	Name	Description
1	Model name	Model name of the module

Number	Name	Description
2	RUN LED indicator (green)	Operating status of the module ON: The module is running. OFF: The module stops running.
3	ERROR LED indicator (red)	Error status of the module Blink: The module is abnormal.
4	USB port	Providing the mini USB communication interface
5	Terminals	Input/Output terminals
6	Arrangement of the input/output terminals	Arrangement of the terminals
7	Extension port	Updating the firmware
8	Label	Nameplate
9	Set screw	Fixing the module
10	Connector	Connecting the module and a backplane
11	Projection	Fixing the module

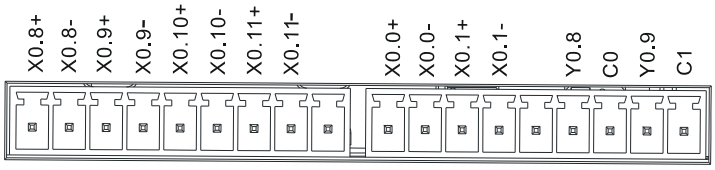
10.2.7 Profile of AH04HC-5A



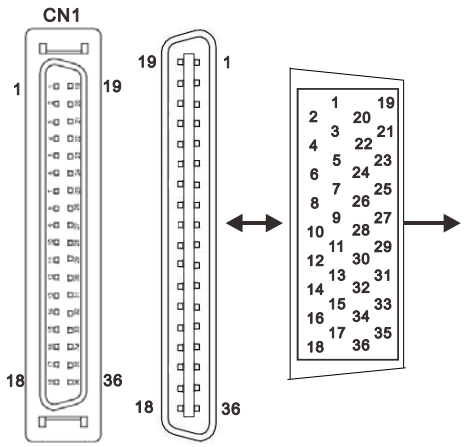
Number	Name	Description
1	Model name	Model name of the module
2	RUN LED indicator (green)	Operating status of the module ON: The module is running. OFF: The module stops running.
3	ERROR LED indicator (red)	Error status of the module Blink: The module is abnormal.
4	USB port	Providing the mini USB communication interface
5	Connector	Connecting the module and an I/O extension cable
6	Extension port	Updating the firmware
7	Label	Nameplate
8	Set screw	Fixing the module
9	Connector	Connecting the module and a backplane
10	Projection	Fixing the module

10.2.8 Arrangement of Input/Output Terminals

- AH02HC-5A



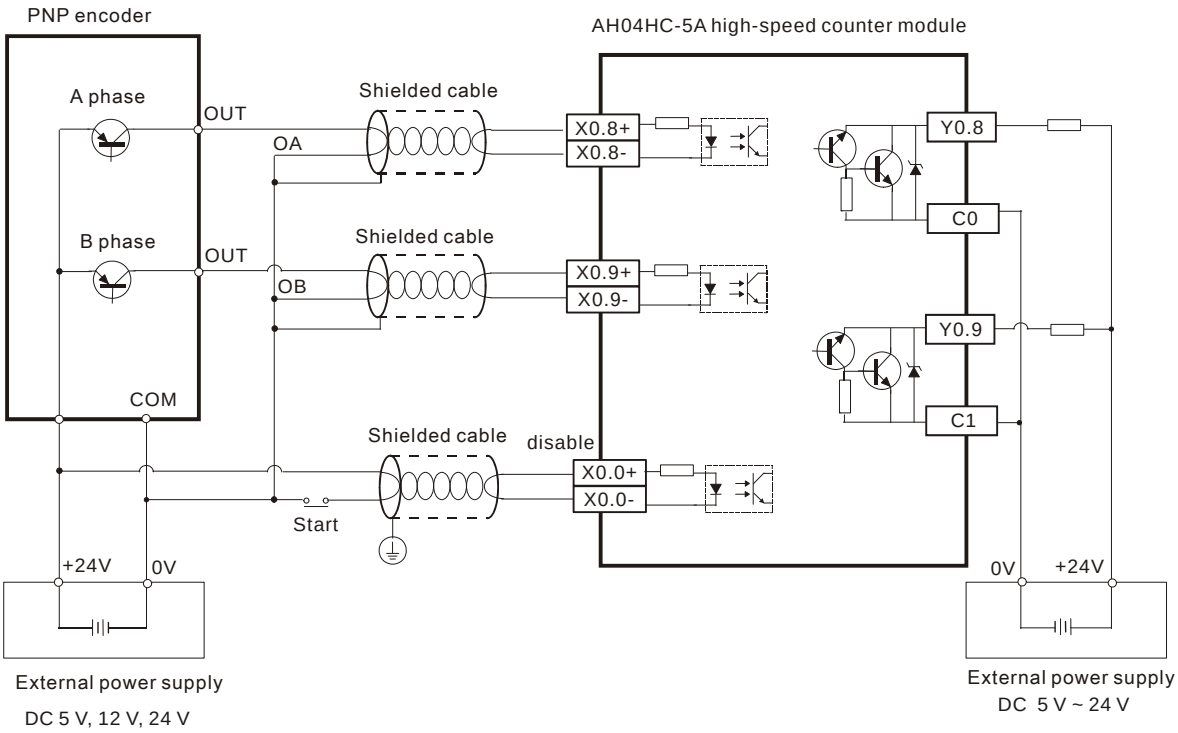
- AH04HC-5A



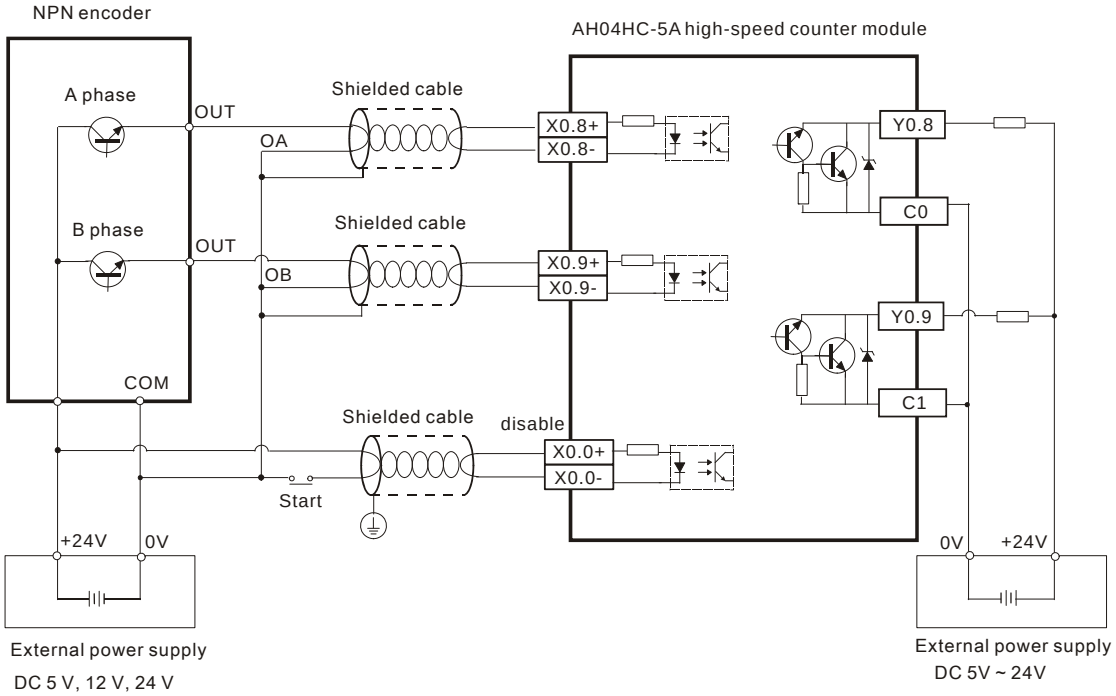
Pin	Terminal	Function Count	Pin	Terminal	Function Count
1	C3	COM3	19	Y0.11	Out3
2	C2	COM2	20	Y0.10	Out2
3	C1	COM1	21	Y0.9	Out1
4	C0	COM0	22	Y0.8	Out0
5	.	.	23	.	.
6	.	.	24	.	.
7	X0.3-	Rst3-	25	X0.3+	Rst3+
8	X0.15-	CntB3-	26	X0.15+	CntB3+
9	X0.14-	CntA3-	27	X0.14+	CntA3+
10	X0.2-	Rst2-	28	X0.2+	Rst2+
11	X0.13-	CntB2-	29	X0.13+	CntB2+
12	X0.12-	CntA2-	30	X0.12+	CntA2+
13	X0.1-	Rst1-	31	X0.1+	Rst1+
14	X0.11-	CntB1-	32	X0.11+	CntB1+
15	X0.10-	CntA1-	33	X0.10+	CntA1+
16	X0.0-	Rst0-	34	X0.0+	Rst0+
17	X0.9-	CntB0-	35	X0.9+	CntB0+
18	X0.8-	CntA0-	36	X0.8+	CntA0+

10.2.9 External Wiring

1. A PNP encoder is used.



2. An NPN encoder is used.



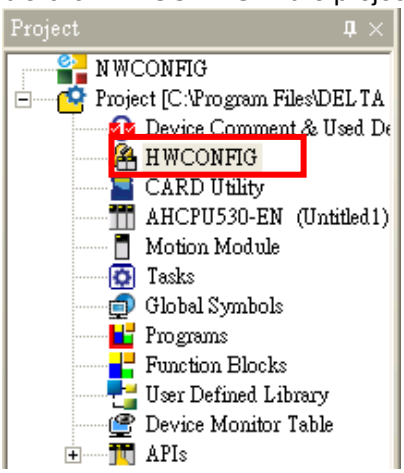
10.3 HWCONFIG in ISPSoft

AH04HC-5A is taken for instance. If the AH500 series high-speed counter module that users use is AH02HC-5A, it is operated in the same way as AH04HC-5A is operated.

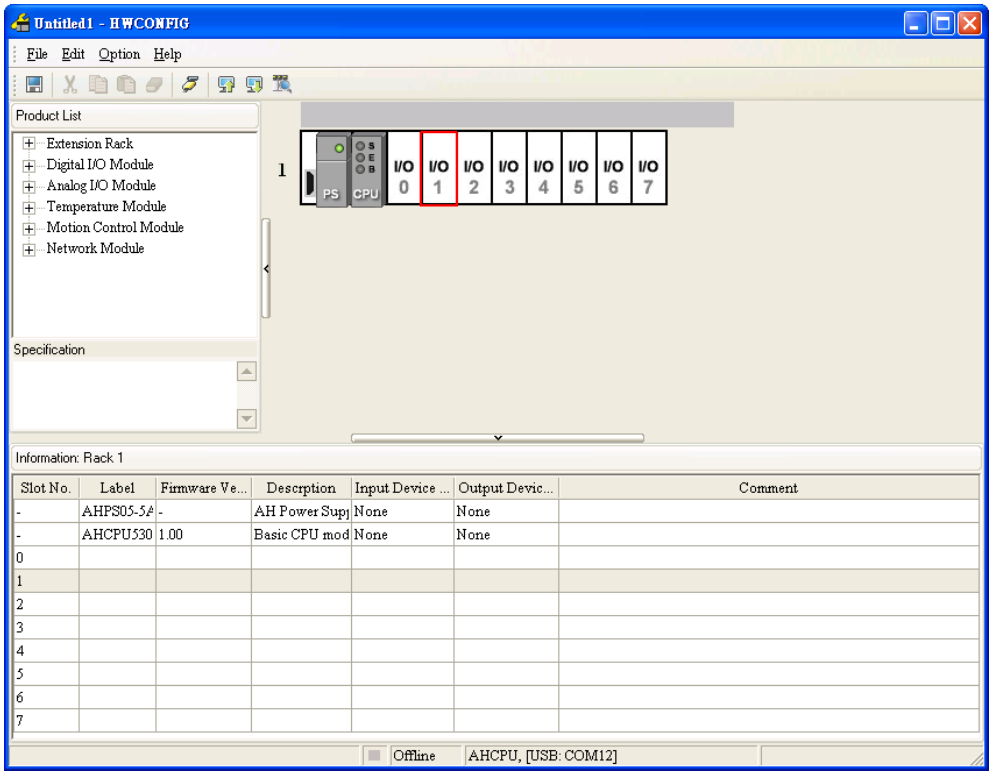
10.3.1 Checking the Firmware Version of a Module

Users can check the firmware version of a module through HWCONFIG in ISPSoft.

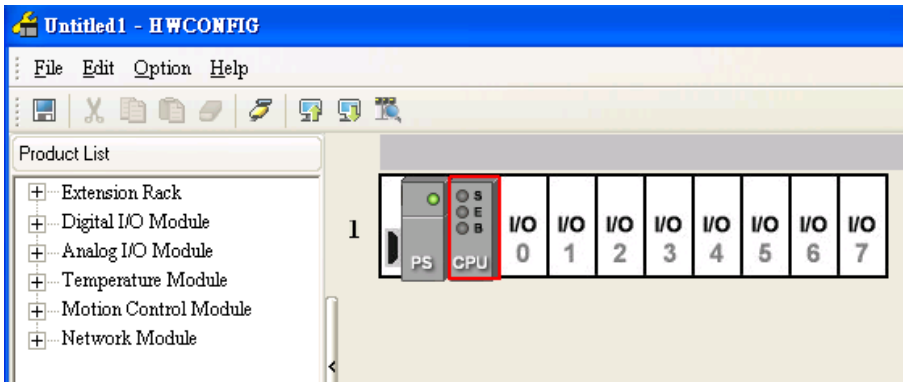
(1) Start ISPSoft, and then double-click **HWCONFIG** in the project management area.



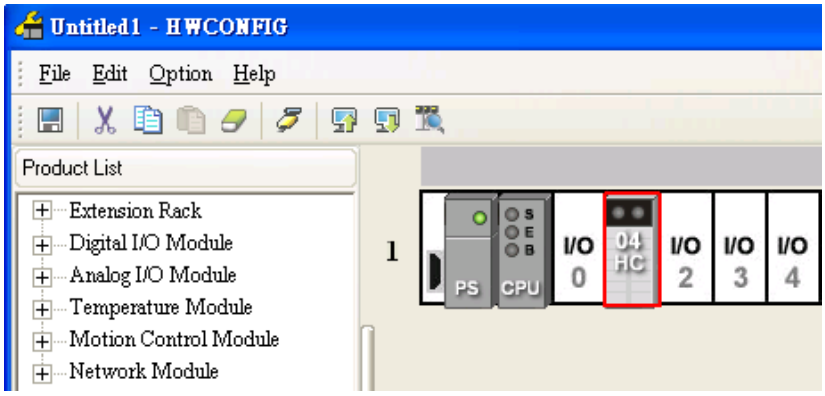
(2) The **HWCONFIG** window is shown below.



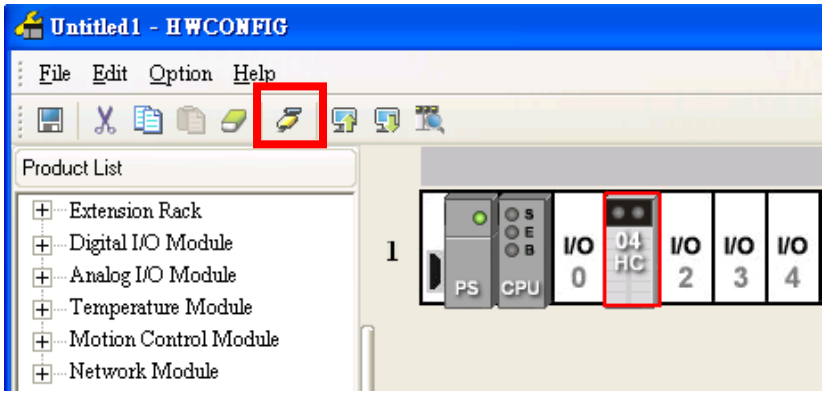
(3) After users click **I/O Scan** on the **Option** menu, the modules installed on the present backplane will be scanned.



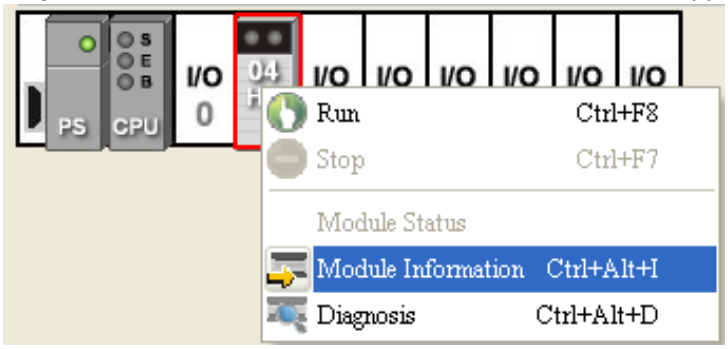
(4) The scan result is shown below. AH04HC-5A is installed in the second slot on the main backplane.



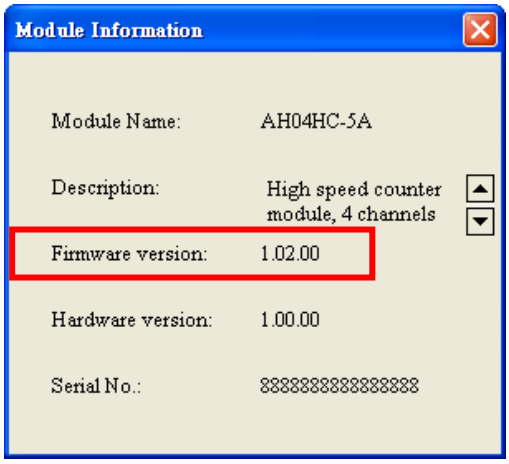
(5) Click **Online Mode** on the toolbar.



(6) After the users right-click the module AH04HC-5A, a context menu will appear.



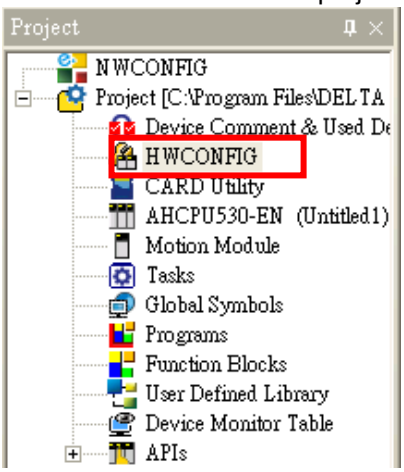
(7) After the users click **Module Information** on the context menu, the **Module Information** window will appear. The firmware version in the red frame in the window below is the firmware version of the module AH04HC-5A.



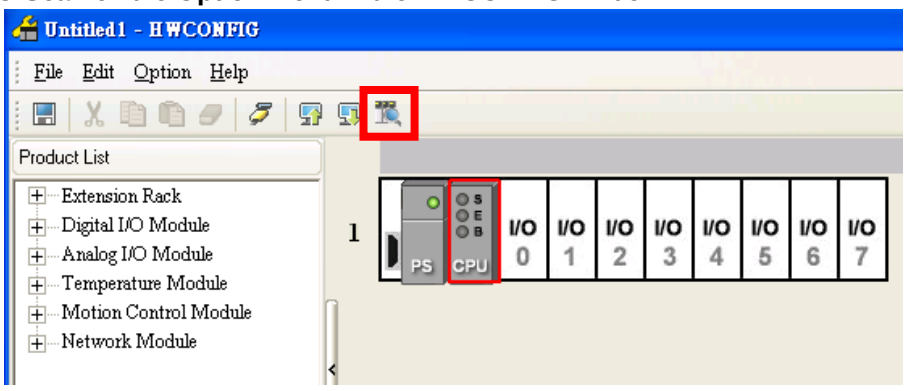
10.4 Initial Setting

Users can set the parameters in a module through ISPSoft. After the parameters are set, they can be downloaded to the module. The steps of setting the parameters in the module AH04HC-5A are as follows.

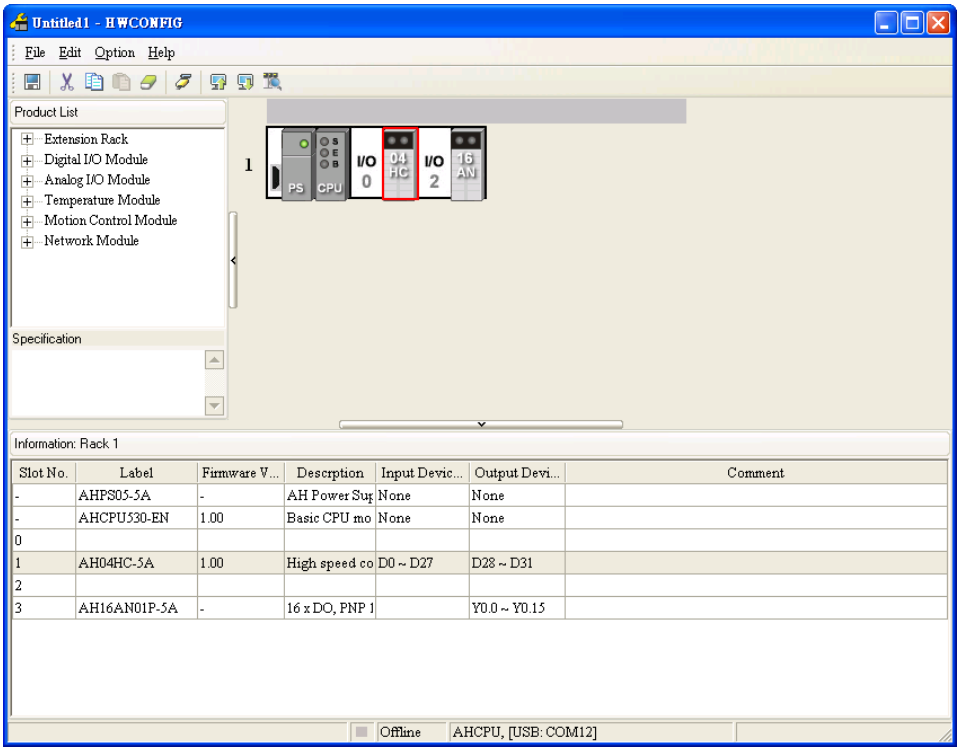
(1) Start ISPSoft, and then double-click **HWCONFIG** in the project management area.



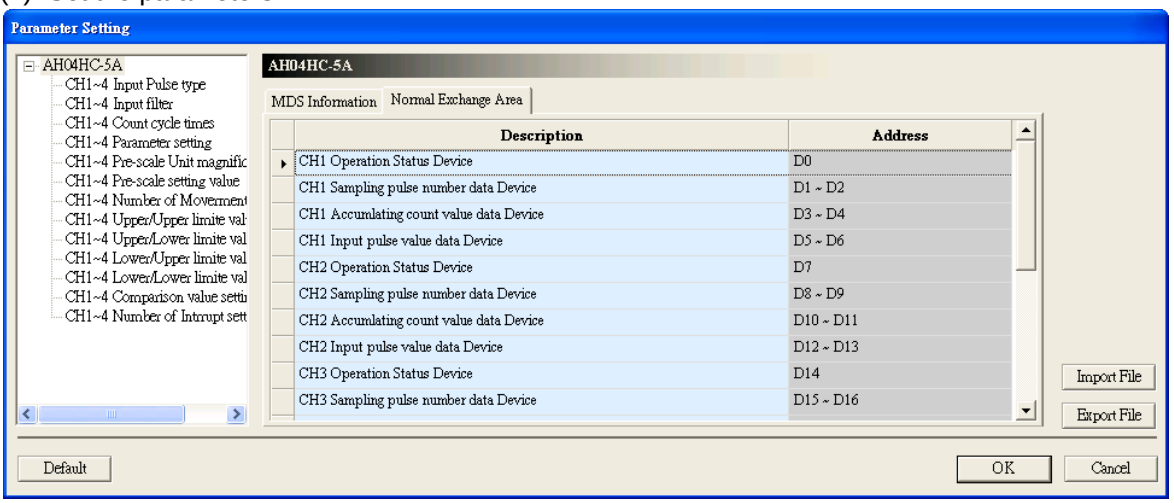
(2) Click **I/O Scan** on the **Option** menu in the **HWCONFIG** window.



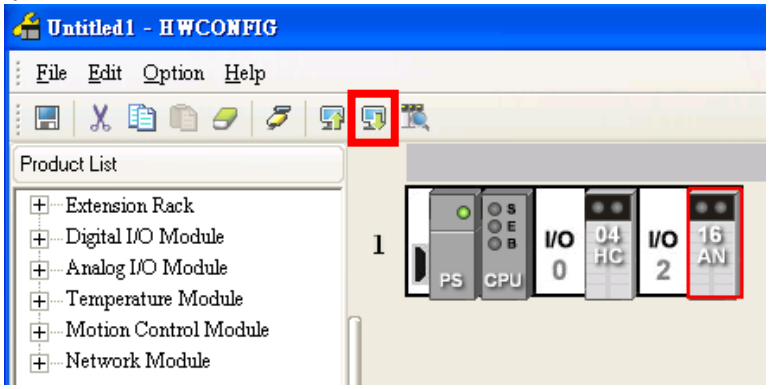
(3) Double-click the module AH04HC-5A.


Untitled1 - HWCONFIG
File Edit Option Help
Product List
Extension Rack
Digital I/O Module
Analog I/O Module
Temperature Module
Motion Control Module
Network Module
Specification
1
PS
CPU
I/O 0
04 HC
I/O 2
16 AN
Information: Rack 1
Slot No. | Label | Firmware V... | Description | Input Devic... | Output Devi... | Comment
- | AHPS05-5A | - | AH Power Sup | None | None
- | AHCPU530-EN | 1.00 | Basic CPU mo | None | None
0
1 | AH04HC-5A | 1.00 | High speed co | D0 ~ D27 | D28 ~ D31
2
3 | AH16AN01P-5A | - | 16 x DO, PNP 1 | | Y0.0 ~ Y0.15
Offline
AHCPU, [USB: COM12]

(4) Set the parameters.

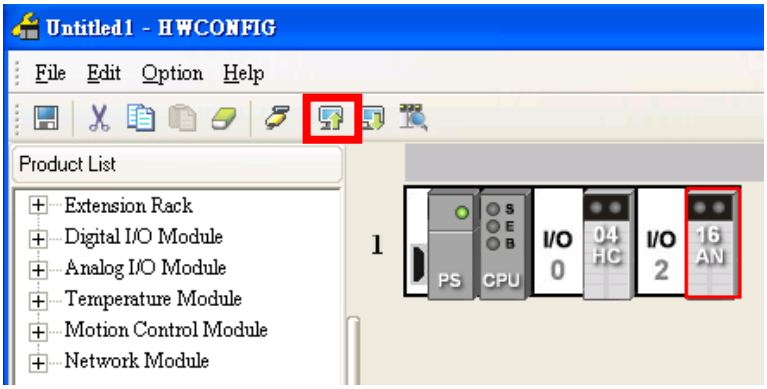

Parameter Setting
AH04HC-5A
CH1~4 Input Pulse type
CH1~4 Input filter
CH1~4 Count cycle times
CH1~4 Parameter setting
CH1~4 Pre-scale Unit magnific
CH1~4 Pre-scale setting value
CH1~4 Number of Movement
CH1~4 Upper/Upper limite val
CH1~4 Upper/Lower limite val
CH1~4 Lower/Upper limite val
CH1~4 Lower/Lower limite val
CH1~4 Comparison value setti
CH1~4 Number of Intrrupt sett
AH04HC-5A
MDS Information
Normal Exchange Area
Description | Address
CH1 Operation Status Device | D0
CH1 Sampling pulse number data Device | D1 ~ D2
CH1 Accumulating count value data Device | D3 ~ D4
CH1 Input pulse value data Device | D5 ~ D6
CH2 Operation Status Device | D7
CH2 Sampling pulse number data Device | D8 ~ D9
CH2 Accumulating count value data Device | D10 ~ D11
CH2 Input pulse value data Device | D12 ~ D13
CH3 Operation Status Device | D14
CH3 Sampling pulse number data Device | D15 ~ D16
Import File
Export File
Default
OK
Cancel

(5) After the setting of the parameters is complete, users can click **Download** on the toolbar to download the parameters to the module.



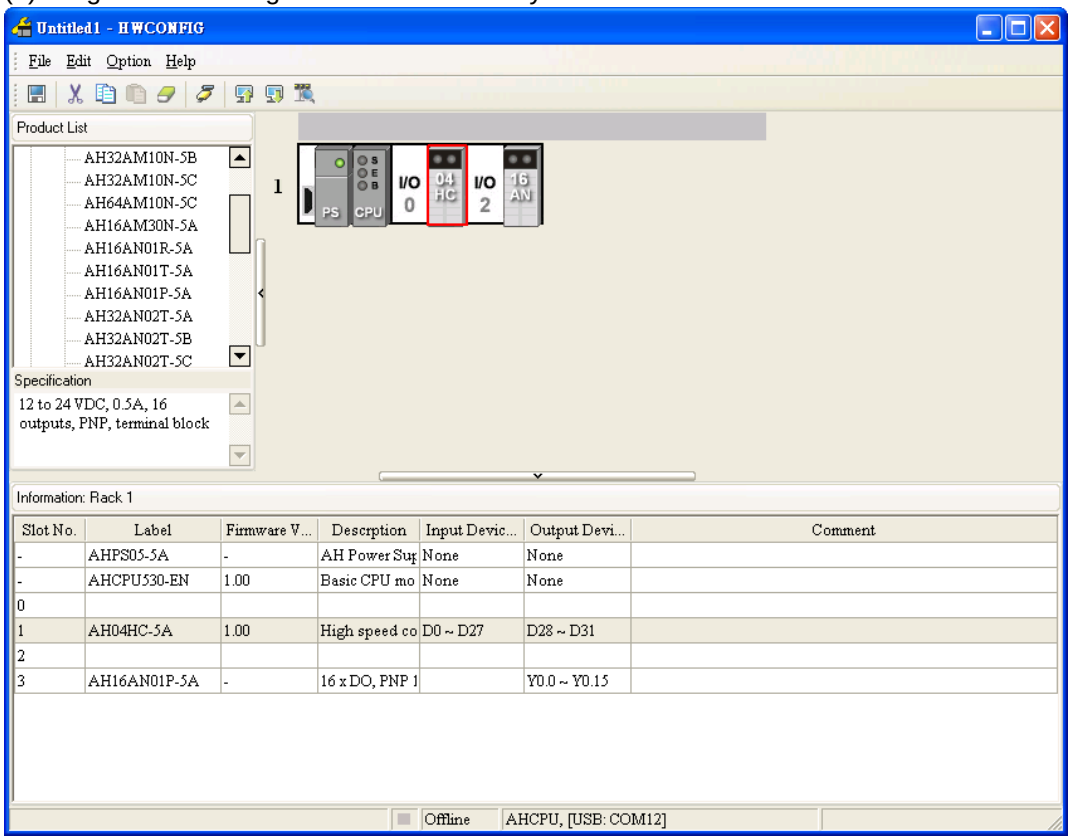
10.5 Updating Parameters

If users click **Upload** on the toolbar in the **HWCONFIG** window, the parameters in the modules will be uploaded. After the users modify the parameters uploaded, they can download the parameters to the modules.



10.6 Monitoring Parameters

(1) Registers are assigned to the modules by means of ISPSoft.


Untitled1 - HWCONFIG
File Edit Option Help
Product List
AH32AM10N-5B
AH32AM10N-5C
AH64AM10N-5C
AH16AM30N-5A
AH16AN01R-5A
AH16AN01T-5A
AH16AN01P-5A
AH32AN02T-5A
AH32AN02T-5B
AH32AN02T-5C
Specification
12 to 24 VDC, 0.5A, 16 outputs, PNP, terminal block
Information: Rack 1
Slot No. | Label | Firmware V... | Description | Input Devic... | Output Devi... | Comment
- | AHPS05-5A | - | AH Power Sup | None | None
- | AHCPU530-EN | 1.00 | Basic CPU mo | None | None
0
1 | AH04HC-5A | 1.00 | High speed co | D0 ~ D27 | D28 ~ D31
2
3 | AH16AN01P-5A | - | 16 x DO, PNP 1 | | Y0.0 ~ Y0.15
Offline
AHCPU, [USB: COM12]

AH04HC-5A has four channels, and uses thirty-two registers in a CPU module. The CPU module reads the values in twenty-eight registers periodically. The commands that the CPU module sends to AH04HC-5A are stored in the remaining four registers. In the figure above, D0~D31 are assigned to AH04HC-5A by means of ISPSoft. The thirty-two registers assigned to AH04HC-5A can be changed manually. The relation between D0~D27 and the four channels that AH04HC-5A has is shown below. The values in the twenty-eight registers are updated every millisecond.

Input devices

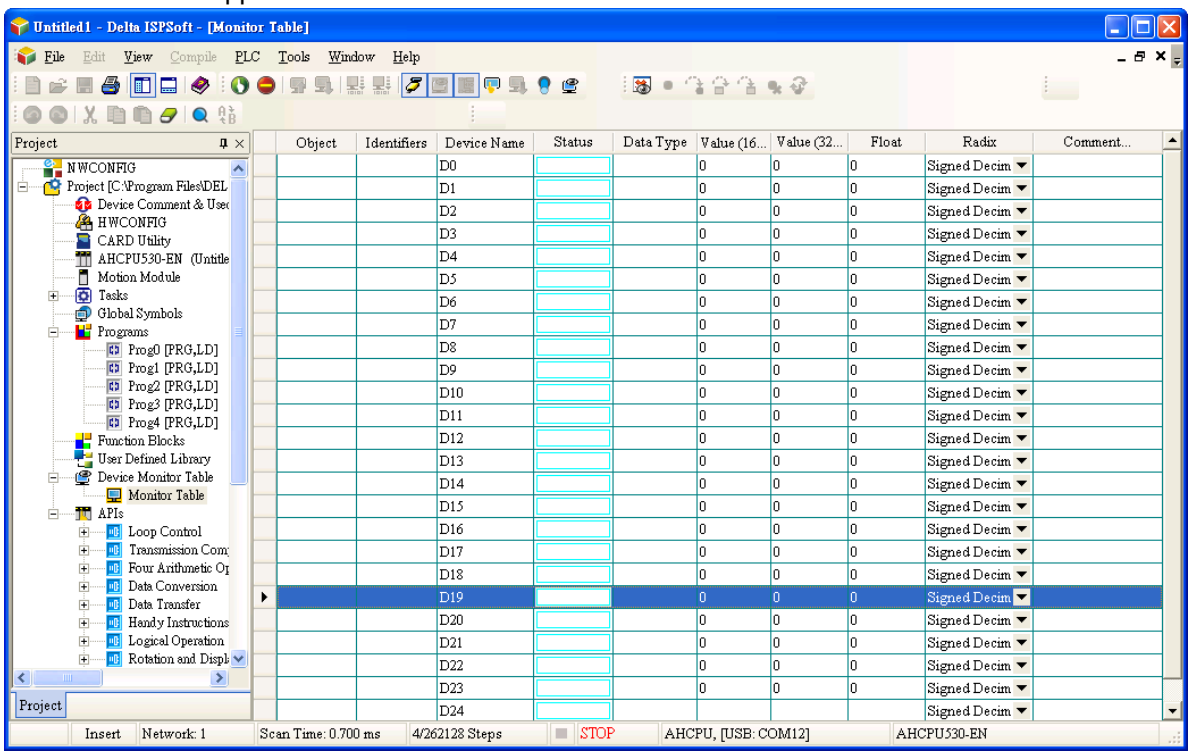
Register	CH1 (*1)	Register	CH2 (*1)	Register	CH3 (*1)	Register	CH4 (*1)	Parameter
D0	#19	D7	#47	D14	#75	D21	#103	Status flag
D1	#20	D8	#48	D15	#76	D22	#104	Number of sampled pulses (Low word)
D2	#21	D9	#49	D16	#77	D23	#105	Number of sampled pulses (high word)
D3	#22	D10	#50	D17	#78	D24	#106	Number of accumulated pulses (Low word)
D4	#23	D11	#51	D18	#79	D25	#107	Number of accumulated pulses (High word)
D5	#24	D12	#52	D19	#80	D26	#108	Number of input pulses (Low word)
D6	#25	D13	#53	D20	#81	D27	#109	Number of input pulses (High word)

Users can monitor the operation of AH04HC-5A by means of a monitoring table. In the figure below, the parameters correspond to D0~D27 are monitored.

Output devices

Register	CH1 (*1)	Register	CH2 (*1)	Register	CH3 (*1)	Register	CH4 (*1)	Parameter
D28	#0	D29	#28	D30	#56	D31	#84	Enabling a parameter

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.



(2) Using the instruction FROM

Please refer to AH500 Programming Manual for more information. Users can read parameters in AH04HC-5A by means of the instruction FROM. The parameters read are stored in the data registers specified. If the users add the data registers to the monitoring table in ISPSoft, they can monitor the parameters when the program is executed.

10.7 Parameter Table

CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)	Attribute	Register name	Default value	Remark
#0	#28	#56	#84	R/W	Enabling a parameter	16#0000	Bit 0~bit 6
#1	#29	#57	#85	R/W	Input waveform	0	0~3
#2	#2	#2	#2	R/W	Filtering pulses	0	0 (No pulses are filtered.), or 4~19
#3	#31	#59	#87	R/W	Cycle of updating the number of pulses	10	1~1000 (Unit: ms)
#4	#32	#60	#88	R/W	Setting the counting function	0	Bit 0~bit 10
#5	#33	#61	#89	R/W	Selecting a scale	0	0~4
#6	#34	#62	#90	R/W	Setting a scale	0	0~32767
#7	#35	#63	#91	R/W	Setting the number of cycles	0	2~60
#8	#36	#64	#92	R/W	Upper-upper limit value (Low word)	0	-200000~200000
#9	#37	#65	#93	R/W	Upper-upper limit value (High word)	0	
#10	#38	#66	#94	R/W	Upper-lower limit value (Low word)	0	-200000~200000
#11	#39	#67	#95	R/W	Upper-lower limit value (High word)	0	
#12	#40	#68	#96	R/W	Lower-upper limit value (Low word)	0	-200000~200000
#13	#41	#69	#97	R/W	Lower-upper limit value (High word)	0	
#14	#42	#70	#98	R/W	Lower-lower limit value (Low word)	0	-200000~200000
#15	#43	#71	#99	R/W	Lower-lower limit value (High word)	0	
#16	#44	#72	#100	R/W	Comparison value (Low word)	0	-999999999~999999999
#17	#45	#73	#101	R/W	Comparison value (High word)	0	
#18	#46	#74	#102	R/W	Interrupt triggered by a comparison	0	0~31
#19	#47	#75	#103	R	Status flag	16#0000	Bit 0~bit 6
#20	#48	#76	#104	R	Number of sampled pulses (Low word)	0	-200000~200000
#21	#49	#77	#105	R	Number of sampled pulses (High word)	0	
#22	#50	#78	#106	R	Number of accumulated pulses (Low word)	0	-999999999~999999999
#23	#51	#79	#107	R	Number of accumulated pulses (High word)	0	
#24	#52	#80	#108	R	Number of input pulses (Low word)	0	-2147483648~2147483647

CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)	Attribute	Register name	Default value	Remark
#25	#53	#81	#109	R	Number of input pulses (High word)	0	
#26	#54	#82	#110	R	Error code	0	Six error codes
#27	#55	#83	#111	Reserved			

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

10.8 Writing Parameters

Users can set the parameters in AH02HC-5A/AH04HC-5A by means of ISPSoft, and enable parameters by means of the output devices assigned to AH02HC-5A/AH04HC-5A. The users can also set the parameters in AH02HC-5A/AH04HC-5A by means of the instruction TO or DTO.

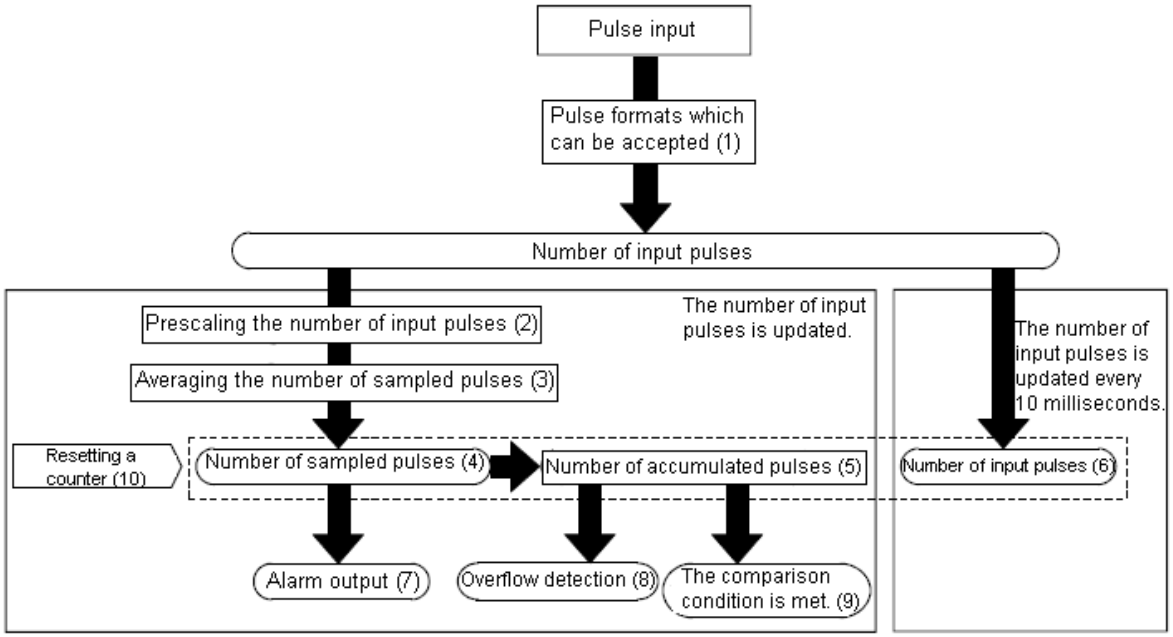
(1) Software: ISPSoft

After AH02HC-5A/AH04HC-5A is installed, HWCONFIG in ISPSoft can be used to set the parameters in AH02HC-5A/AH04HC-5A. Users can not start AH02HC-5A/AH04HC-5A by means of HWCONFIG in ISPSoft. However, parameters can be enabled by the output devices in the program written in ISPSoft.

(2) Instruction: TO or DTO

Parameters can be changed by means of the instruction TO or DTO. Users can stop AH02HC-5A/AH04HC-5A from counting by means of TO or DTO during the operation of AH02HC-5A/AH04HC-5A. However, they can not change the other parameters by means of TO or DTO during the operation of AH02HC-5A/AH04HC-5A. If the users want to write parameters by means of TO, the maximum data length is 128 words. If the users want to write parameters by means of DTO, the maximum data length is 64 double words.

10.9 Descriptions of the Control Registers


Pulse input
Pulse formats which can be accepted (1)
Number of input pulses
Prescaling the number of input pulses (2)
Averaging the number of sampled pulses (3)
The number of input pulses is updated.
The number of input pulses is updated every 10 milliseconds.
Resetting a counter (10)
Number of sampled pulses (4)
Number of accumulated pulses (5)
Number of input pulses (6)
Alarm output (7)
Overflow detection (8)
The comparison condition is met. (9)

10.9.1 Setting Parameters

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#0	-	#28	-	#56	-	#84

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

[Description]
Bit 0~bit 15 are described below.

bit#	Description
0	Starting the count
1	Resetting the sampling register/accumulation register/pulse input register Resetting bit 1 in CR19/CR47/CR75/CR103
2	Resetting bit 2 in CR19/CR47/CR75/CR103
3	Resetting bit 3 in CR19/CR47/CR75/CR103
4-5	Reserved
6	Clearing the error flag
7~15	Reserved

*. Bit 1~bit3 and bit6 will be turned OFF automatically after the related functions are fulfilled.

1. Bit 0 in CR0/CR28/CR56/CR84: ON: Starting the count; OFF: Stopping the count
   a. Starting the count: If bit 0 in CR0/CR28/CR56/CR84 is turned from OFF to ON, and the parameters are set correctly, the system will start the count. If the parameters are set incorrectly, bit 0 in CR0/CR28/CR56/CR84 will be turned OFF immediately, and bit 6 in CR19/CR47/CR75/CR103 will be turned ON. Users can read the error code in CR26/CR54/CR82/CR110.
   b. Stopping the count: If bit 0 in CR0/CR28/CR56/CR84 is turned from ON to OFF, the system will stop the count.
2. Bit 1 in CR0/CR28/CR56/CR84: If bit 1 in CR0/CR28/CR56/CR84 is turned ON, the sampling register/accumulation register/pulse input register, and bit 1 in CR19/CR47/CR75/CR103 will be reset. After the sampling register/accumulation register/pulse input register, and bit 1 in CR19/CR47/CR75/CR103 is reset, bit 1 in CR0/CR28/CR56/CR84 will be turned OFF automatically.
   a. If bit 1 in CR0/CR28/CR56/CR84 is turned ON, the sampling register/accumulation register/pulse input register will be reset to 0 immediately.
   b. If the linear accumulation is larger than 999999999 or less than -999999999, the value in the accumulation register will be 999999999 or -999999999, and bit 1 in CR19/CR47/CR75/CR103 will be turned ON. If bit 1 in CR0/CR28/CR56/CR84 is turned ON, bit 1 in CR19/CR47/CR75/CR103 will be turned OFF.
3. Bit 2 in CR0/CR28/CR56/CR84: If bit 2 is turned ON, bit 2 in CR19/CR47/CR75/CR103 will be reset. After the circular accumulation is reset, bit 2 in CR0/CR28/CR56/CR84 will be turned OFF automatically.
   If the circular accumulation is larger than 999999999 or less than -999999999, bit 2 in CR19/CR47/CR75/CR103 will be turned ON. If bit 2 in CR0/CR28/CR56/CR84 is turned ON, bit 2 in CR19/CR47/CR75/CR103 will be turned OFF.
4. Bit 3 in CR0/CR28/CR56/CR84: If bit 3 in CR0/CR28/CR56/CR84 is turned ON, bit 3 in CR19/CR47/CR75/CR103 will be reset. After bit 3 in CR19/CR47/CR75/CR103 is reset, bit 3 in CR0/CR28/CR56/CR84 will be turned OFF automatically.
   If the value in the accumulation register meets the comparison condition set, bit 3 in CR19/CR47/CR75/CR103 will be turned ON. If bit 3 in CR0/CR28/CR56/CR84 is turned ON, bit 3 in CR19/CR47/CR75/CR103 will be turned OFF.
5. Bit 6 in CR0/CR28/CR56/CR84: If bit 6 in CR0/CR28/CR56/CR84 is turned ON, the error flag will be cleared. After the error flag is cleared, bit 6 in CR0/CR28/CR56/CR84 will be turned OFF.
   If bit 0 in CR0/CR28/CR56/CR84 is turned from OFF to ON, and the parameters are set

incorrectly, bit 6 in CR19/CR47/CR75/CR103 will be turned ON immediately. Users can read the error code in CR26/CR54/CR82/CR110. If bit 6 in CR0/CR28/CR56/CR84 is turned ON, bit 6 in CR19/CR47/CR75/CR103 will be turned OFF.

10.9.2 Input Waveform

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#1	-	#29	-	#57	-	#85

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

Bit 1	Bit 0	Description
0	0	Double pulse (counting up/counting down)
0	1	P/D Single pulse (pulse/direction)
1	0	One time the frequency of A/B-phase inputs
1	1	Four times the frequency of A/B-phase inputs

10.9.3 Filtering Pulses

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#2	-	#2	-	#2	-	#2

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

1. Filter coefficient $= \frac{85000}{2^{N+4}}$ (KHz); N=0~19

   The conversion results are shown in the following table.

N	kHz	N	kHz
0	No pulses are filtered.	10	5.187988
1	2656.2504	11	2.593994
2	1328.1252	12	1.296997
3	664.0626	13	0.648499
4	332.0313	14	0.324249
5	166.0156	15	0.162125
6	83.00781	16	0.081062
7	41.50391	17	0.040531
8	20.75195	18	0.020266
9	10.37598	19	0.010133

2. If the value in CR#2 is 0, the external input terminals do not filter pulses. If the value in CR#2 is larger than 19, the value will be counted as 0. For example, if the value in CR#2 is 10, the filter coefficient is $\frac{85000}{2^{10+4}} = 5.187988$ (KHz). That is, the input signals whose frequencies are larger than 5.187988 kHz are filtered.

10.9.4 Setting the Cycle of Updating the Number of Pulses

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#3	-	#31	-	#59	-	#87

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

[Description]
Setting the cycle of updating the number of pulses

Item	Setting value
Cycle of updating the number of pulses	1~1000 (Unit: ms)

If the setting value is larger than 1000, the cycle will be counted as 1000 milliseconds. If the setting value is less than 1, the cycle will be counted as 1 millisecond.

10.9.5 Setting the Counting Functions

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#4	-	#32	-	#60	-	#88

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

[Description]
Bit 0~bit 15 are described below.

bit#	Description
0	Setting the polarities of the input contacts OFF: Normally-open contacts ON: Normally-closed contacts
1	Setting the function of prescaling the number of input pulses OFF: The function is disabled. ON: The function is enabled.
2	Setting the function of averaging the number of sampled pulses OFF: The function is disabled. ON: The function is enabled.
3	Setting the alarm function OFF: The function is disabled. ON: The function is enabled.
4	Setting the accumulation register OFF: The accumulation register counts linearly. ON: The accumulation register counts circularly.
5	Setting the function of comparing the number of accumulated pulses with the comparison value set OFF: The function is disabled. ON: The function is enabled.
6	Selecting a type of comparison condition OFF: ≧ ON: ≦ (*. Bit 5 in CR4/CR32/CR60/CR88 must be turned ON.)
7	Setting the function of outputting a hardware signal OFF: The function is disabled. ON: The function is enabled. (*. Bit 5 in CR4/CR32/CR60/CR88 must be turned ON.)

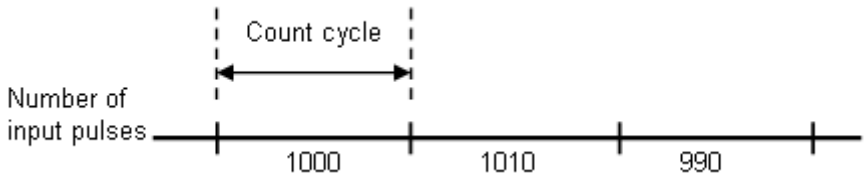
bit#	Description
8	Setting the function of sending a message which asks the CPU module to execute the interrupt subroutine specified to the CPU module OFF: The function is disabled. ON: The function is enabled. (*. Bit 5 in CR4/CR32/CR60/CR88 must be turned ON.)
9	Setting the function of clearing the number of sampled pulses, the number of accumulated pulses, and the number of input pulses OFF: The function is disabled. ON: The function is enabled.
10	Setting the polarity of the input contact of the external signal OFF: Normally-open contacts ON: Normally-closed contacts
8~15	Reserved

1. Bit 0 in CR4/CR32/CR60/CR88: If bit 0 in CR4/CR32/CR60/CR88 is turned ON, the input contacts will be normally-closed contacts. If bit 0 in CR4/CR32/CR60/CR88 is turned OFF, the input contacts are normally-open contacts.
2. Bit 1 in CR4/CR32/CR60/CR88: If bit 1 in CR4/CR32/CR60/CR88 is turned ON, the function of prescaling the number of input pulses will be enabled. If bit 1 in CR4/CR32/CR60/CR88 is turned OFF, the function of prescaling the number of input pulses will be disabled.
   The function of prescaling the number of input pulses converts the number of input pulses into the corresponding physical quantity.
   Number of sampled pulses
   =Number of pulses count during a cycle x Scale set by users x Magnification

Item	Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Selecting a scale (magnification)	0: x1 1: x0.1 2: x0.01 3: x0.001 4: x0.0001	#5	#33	#61	#89
Setting a scale	0~32767	#6	#34	#62	#90

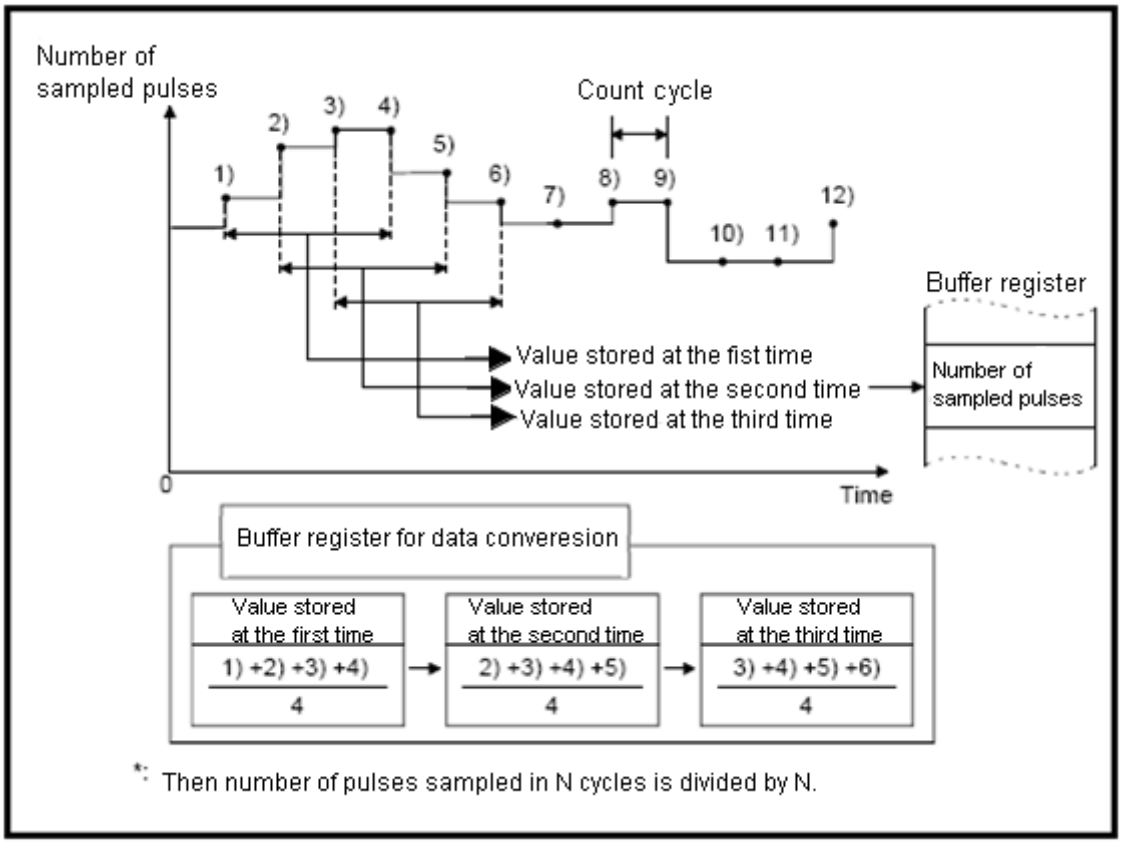
*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

(Number of input pulses count during a cycle)



(Example)
A flow counter is used. A pulse represents a flow of 5 cm^3. The magnitude set is 1.
Setting a scale: 5
Selecting a scale: 0: x1
Cycle: 0: 1 second
The figure above shows that the number of input pulses count during the first cycle is 1000.
Number of sampled pulses
=Number of pulses count during a cycle x Scale set by users x Magnification
=1000x5x1=5000 (cm^3/s)

3. Bit 2 in CR4/CR32/CR60/CR88: If bit 2 in CR4/CR32/CR60/CR88 is turned ON, the function of averaging the number of sampled pulses will be enabled. If bit 2 in CR4/CR32/CR60/CR88 is turned OFF, the function of averaging the number of sampled pulses will be disabled.
   The function of averaging the number of sampled pulses prevents the number of pulses sampled in a cycle form being abnormal. Then number of pulses sampled in N cycles is divided by N. In the figure below, the number of pulses sampled in 4 cycles is divided by 4.



Item	Value/Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Number of sampled pulses (Low word)	-200000~200000	#20	#48	#76	#104
Number of sampled pulses (High word)		#21	#49	#77	#105
Number of cycles	2~60	#7	#35	#63	#91

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

4. Bit 3 in CR4/CR32/CR60/CR88: If bit 3 in CR4/CR32/CR60/CR88 is turned ON, the alarm function is enabled. If bit 3 in CR4/CR32/CR60/CR88 is turned OFF, the alarm function is disabled. After the alarm function is enabled, bit 4 or bit 5 in CR19/CR47/CR75/CR103 will be turned ON if the number of pulses sampled in a cycle is larger than the upper-upper limit value set or less than the lower-lower limit value set. If the number of sampled pulses is between the upper-lower limit value set and the lower-upper limit value set, bit 4 or bit 5 in CR19/CR47/CR75/CR103 will be turned OFF. If users want to use the alarm function, they have to set an upper-upper limit value, an upper-lower limit value, a lower-upper limit value, and a lower-lower limit value.

Item	Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Upper-upper limit value (Low word)	-200000~200000	#8	#36	#64	#92
Upper-upper limit value (High word)		#9	#37	#65	#93
Upper-lower limit value (Low word)	-200000~200000	#10	#38	#66	#94
Upper-lower limit value (High word)		#11	#39	#67	#95
Lower-upper limit value (Low word)	-200000~200000	#12	#40	#68	#96
Lower-upper limit value (High word)		#13	#41	#69	#97
Lower-lower limit value (Low word)	-200000~200000	#14	#42	#70	#98
Lower-lower limit value (High word)		#15	#43	#71	#99

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

The setting of the four limit values must comply with the rules listed below.

(1) The four limit values must be in the range of -200000 to 200000.

(2) Upper-upper limit value≧Upper-lower limit value > Lower-upper limit value≧Lower-lower limit value

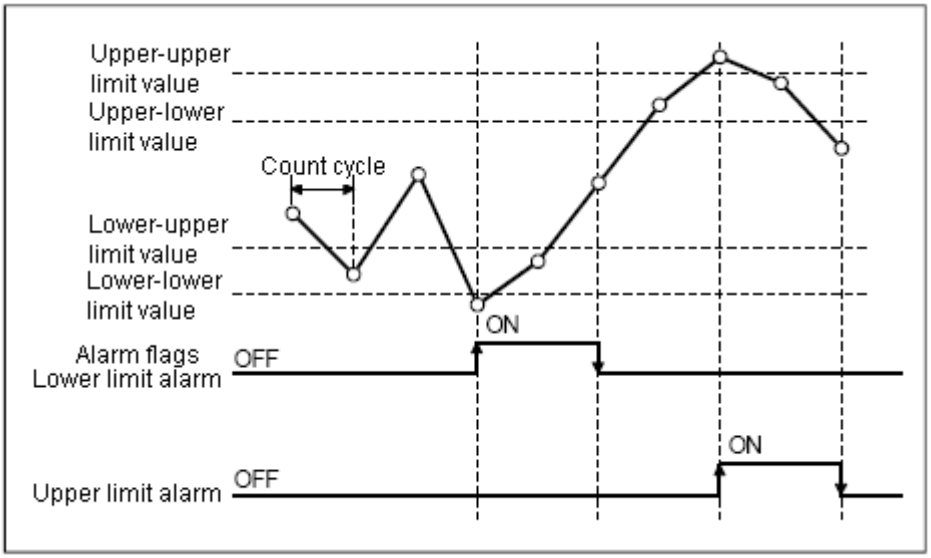
If the setting of the four limit values does not comply with the rules listed above, and the alarm function is enabled, bit 6 in CR19/CR47/CR75/CR103 will be turned ON. Users can read the error code 16#A0n5 in CR26/CR54/CR82/CR110. (n is a channel number. n: 0~3 (i.e. channel 1~channel 4))

The alarm flags are described below.

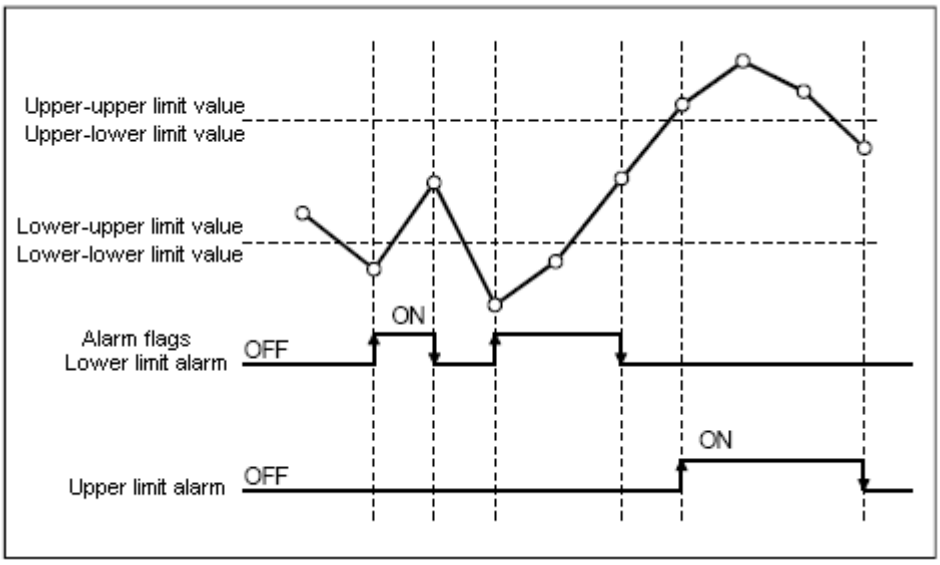
Item	Value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Alarm flags	Bit 4: Upper limit alarm Bit 5: Lower limit alarm	#19	#47	#75	#103

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

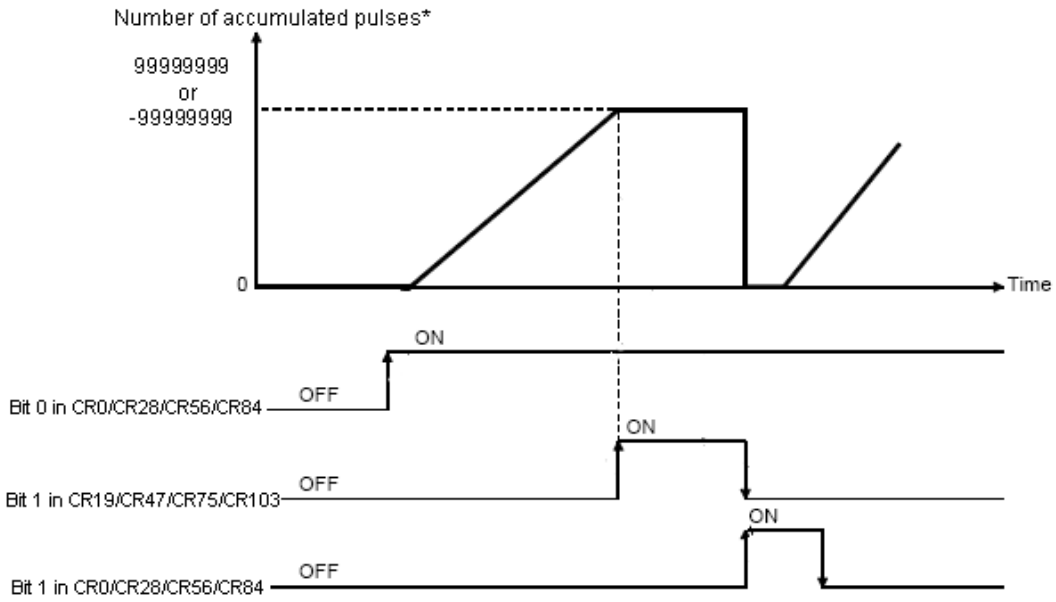
The operation of the upper limit alarm and the operation of the lower limit alarm are shown below.



If the upper-upper limit value is equal to the upper-lower limit value, and the lower-upper limit value is equal to the lower-lower limit value, the operation of the upper limit alarm and the operation of the lower limit alarm are shown below.



5. Bit 4 in CR4/CR32/CR60/CR88: If bit 4 in CR4/CR32/CR60/CR88 is turned OFF, the accumulation register counts linearly. If bit 4 in CR4/CR32/CR60/CR88 is turned ON, the accumulation register counts circularly.
   (1) Linear accumulation:
   If an accumulation register counts up, it counts from 0 to 999999999. If an accumulation register counts down, it counts from 0 to -999999999.
   If the value in an accumulation register is larger than 999999999 or less than -999999999, bit 1 in CR19/CR47/CR75/CR103 will be turned ON. Users can read the error code 16#A0n1 in CR26/CR54/CR82/CR110. (n is a channel number. n: 0~3 (i.e. channel 1~channel 4))



*: The cycle of updating the number of sampled pulses is the cycle set.

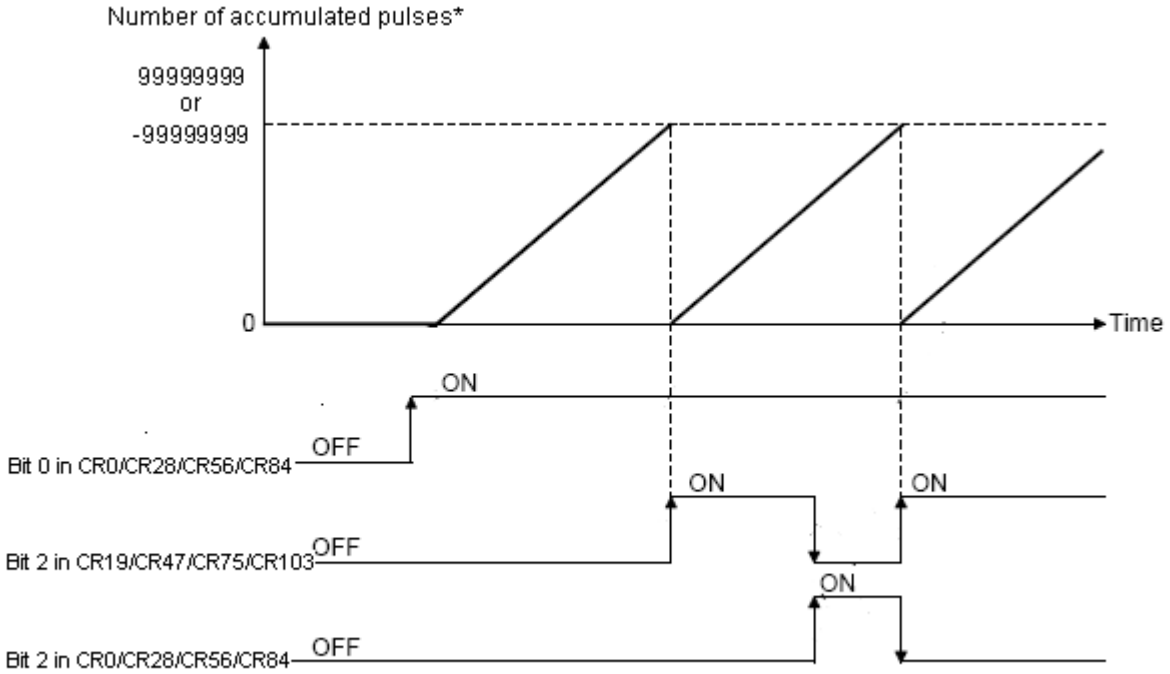
If the linear accumulation is larger than 999999999 or less than -999999999, the value in the accumulation register will be 999999999 or -999999999, and bit 1 in CR19/CR47/CR75/CR103 will be turned ON. Users can read the error code 16#A0n1 in CR26/CR54/CR82/CR110. (n is a channel number. n: 0~3 (i.e. channel 1~channel 4)) If bit 1 in CR0/CR28/CR56/CR84 is turned ON, the sampling register/accumulation register/pulse input register, and bit 1 in CR19/CR47/CR75/CR103 will be reset. After the sampling register/accumulation register/pulse input register, and bit 1 in CR19/CR47/CR75/CR103 is reset, bit 1 in CR0/CR28/CR56/CR84 will be turned OFF automatically.
The related parameters are described below.

Item	Value/Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Number of accumulated pulses (Low word)	-999999999~999999999	#22	#50	#78	#106
Number of accumulated pulses (High word)		#23	#51	#79	#107
Status flag	Bit 1: The linear accumulation is larger than the maximum value or less than the minimum value.	#19	#47	#75	#103
Enabling a parameter	Bit 1: Resetting the sampling register/accumulation register/pulse input register, and bit 1 in CR19/CR47/CR75/CR103	#0	#28	#56	#84

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

(2) Circular accumulation:
If an accumulation register counts up, it counts from 0 to 999999999. If an accumulation

register counts down, it counts from 0 to -999999999.
If the circular accumulation is larger than 999999999 or less than -999999999, bit 2 in CR19/CR47/CR75/CR103 will be turned ON, and the value in the accumulation register will become 0. If bit 2 in CR19/CR47/CR75/CR103 is not reset to OFF, it will still be turned ON. If bit 2 in CR19/CR47/CR75/CR103 is reset to OFF, it will be turned ON next time the circular accumulation is larger than 999999999 or less than -999999999.



*: The cycle of updating the number of sampled pulses is the cycle set.

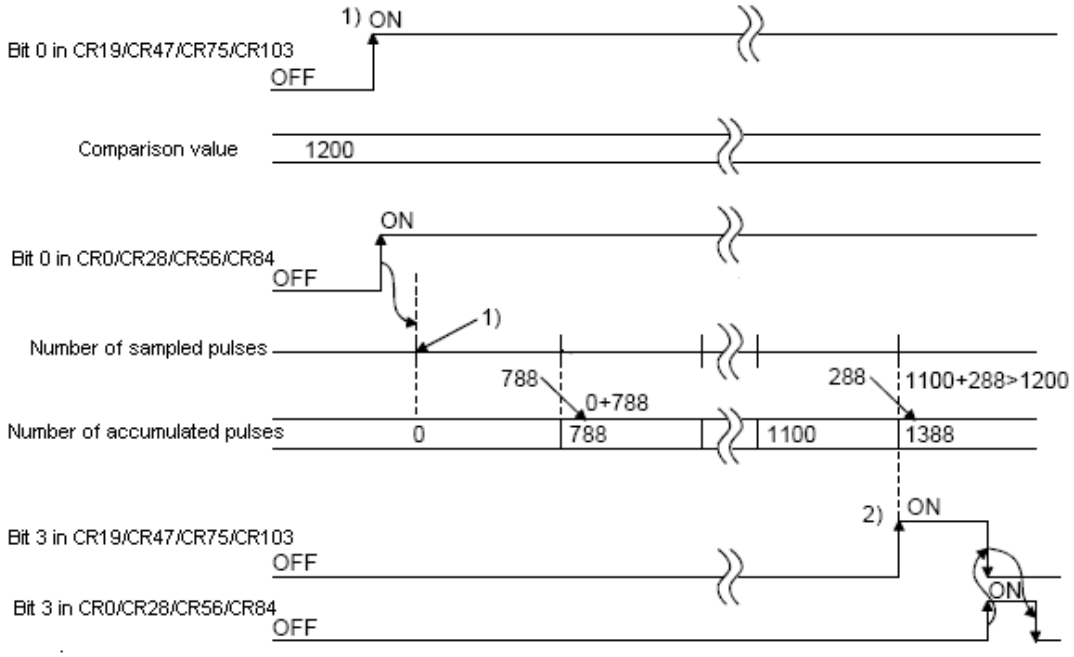
The related parameters are described below.

Item	Value/Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Number of accumulated pulses (Low word)	-999999999~999999999	#22	#50	#78	#106
Number of accumulated pulses (High word)		#23	#51	#79	#107
Status flag	Bit 2: The circular accumulation is equal to the maximum value or the minimum value.	#19	#47	#75	#103
Enabling a parameter	Bit 2: Resetting bit 2 in CR19/CR47/CR75/CR103	#0	#28	#56	#84

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

6. Bit 5 in CR4/CR32/CR60/CR88: If bit 5 in CR4/CR32/CR60/CR88 is turned ON, the function of comparing the number of accumulated pulses with the comparison value set is enabled. If bit 5 in CR4/CR32/CR60/CR88 is turned OFF, the function of comparing the number of accumulated pulses with the comparison value set is disabled.
   The number of accumulated pulses is compared with the comparison value set. If the number of accumulated pulses meets the comparison condition set, bit 3 in CR19/CR47/CR75/CR103 will be turned ON. If bit 3 in CR0/CR28/CR56/CR84 is turned ON, bit 3 in CR19/CR47/CR75/CR103 will be turned OFF. There are two types of comparison conditions. One is ≧, and the other is ≦. If an accumulation register counts up, ≧ can be used. If an accumulation register counts down, ≦ can be used. Users can select a comparison condition

according to their needs.



(1) If bit 0 in CR0/CR28/CR56/CR84 is turned ON, bit 0 in CR19/CR47/CR75/CR103 will be turned ON, and the system will start the count.

(2) If the number of accumulated pulses is larger than or equal to the comparison value, bit 3 in CR19/CR47/CR75/CR103 will be turned ON. If bit 3 in CR0/CR28/CR56/CR84 is turned ON, bit 3 in CR19/CR47/CR75/CR103 will be turned OFF.

The related parameters are described below.

Item	Value/Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Setting the counting function	Bit 4: Setting the accumulation register Bit 6: Selecting a type of comparison condition (OFF: ≧; ON: ≦)	#4	#32	#60	#88
Number of accumulated pulses (Low word)	-999999999~999999999	#22	#50	#78	#106
Number of accumulated pulses (High word)		#23	#51	#79	#107
Comparison value (Low word)	-999999999~999999999	#16	#44	#72	#100
Comparison value (High word)		#17	#45	#73	#101
Status flag	Bit 3: The number of accumulated pulses meets the comparison condition set.	#19	#47	#75	#103
Enabling a parameter	Bit 3: Resetting bit 3 in CR19/CR47/CR75/CR103	#0	#28	#56	#84

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

7. Bit 6 in CR4/CR32/CR60/CR88: If bit 6 in CR4/CR32/CR60/CR88 is turned OFF, ≧ is selected. If bit 6 in CR4/CR32/CR60/CR88 is turned ON, ≦ is selected. Before users select a type of

comparison condition, bit 5 in CR4/CR32/CR60/CR88 must be turned ON.

8. Bit 7 in CR4/CR32/CR60/CR88: After bit 7 in CR4/CR32/CR60/CR88 is turned OFF, AH04HC-5A will not output any hardware signal if the number of accumulated pulses meets the comparison condition set. After bit 7 in CR4/CR32/CR60/CR88 is turned ON, AH04HC-5A will output a hardware signal if the number of accumulated pulses meets the comparison condition set. Before users setting bit 7 in CR4/CR32/CR60/CR88, bit 5 in CR4/CR32/CR60/CR88 must be turned ON. The related hardware signals are described below.

Item	CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Hardware signal	Y0.8	Y0.9	Y0.10	Y0.11

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

9. Bit 8 in CR4/CR32/CR60/CR88: After bit 8 in CR4/CR32/CR60/CR88 is turned OFF, AH04HC-5A will not send a message which asks the CPU module to execute the interrupt subroutine specified to the CPU module if bit 3 in CR19/CR47/CR75/CR103 is turned from OFF to ON. After it 8 in CR4/CR32/CR60/CR88 is turned ON, AH04HC-5A will send a message which asks the CPU module to execute the interrupt subroutine specified to the CPU module if bit 3 in CR19/CR47/CR75/CR103 is turned from OFF to ON. The related parameter is described below.

Item	Value/Setting value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Interrupt number	0~31	#18	#46	#74	#102

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

10. Bit 9 in CR4/CR32/CR60/CR88: After bit 9 in CR4/CR32/CR60/CR88 is turned OFF, the number of sampled pulses, the number of accumulated pulses, and the number of input pulses will not be cleared if X0.0+ and X0.0–/X0.1+ and X0.1–/X0.2+ and X0.2–/X0.3+ and X0.3– turned ON. After bit 9 in CR4/CR32/CR60/CR88 is turned ON, the number of sampled pulses, the number of accumulated pulses, and the number of input pulses will be cleared if the external signals X0.0+ and X0.0–/X0.1+ and X0.1–/X0.2+ and X0.2–/X0.3+ and X0.3– are turned ON. The related parameter is described below.

Item	CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
External signal	X0.0+ and X0.0–	X0.1+ and X0.1–	X0.2+ and X0.2–	X0.3+ and X0.3–

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

11. Bit 10 in CR4/CR32/CR60/CR88: If bit 10 in CR4/CR32/CR60/CR88 is turned ON, the input contact of the external signal is a normally-closed contact. If bit 10 in CR4/CR32/CR60/CR88 is turned OFF, the input contact of the external signal is a normally-open contact.

10.9.6 Status Flag

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	**Low word**	**High word**	**Low word**	**High word**	**Low word**	**High word**	**Low word**
-	#19	-	#47	-	#75	-	#103

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

[Description]
Bit 0~bit 15 are described below.

bit#	Described
0	The setting of the counting function is complete.
1	The linear accumulation is larger than the maximum value or less than the minimum value.
2	The circular accumulation is equal to the maximum value or the minimum value.

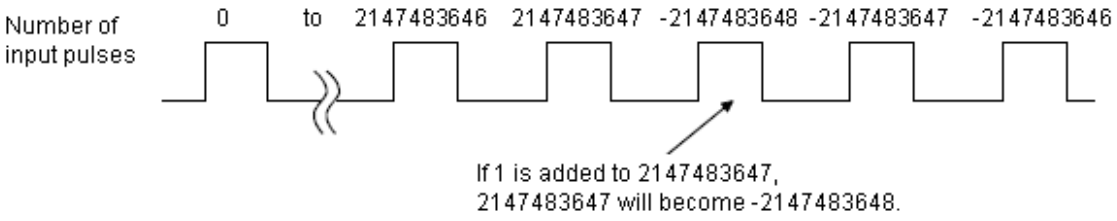
bit#	Described
3	The number of accumulated pulses meets the comparison condition set.
4	Upper limit alarm
5	Lower limit alarm
6	Error flag
7~15	Reserved

10.9.7 Number of Input Pulses

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
#25	#24	#53	#52	#81	#80	#109	#108

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4.
AH04HC-5A supports channel 1~channel 4.

[Description]
The number of input pulses is stored in a pulse input register. If bit 0 in CR0/CR28/CR56/CR84 is turned ON, and the parameters are set correctly, the system will start the count. The number of input pulses is neither prescaled nor averaged. The input pulses are count circularly. The number of input pulses is in the range of -2147483648 to 2147483647.



Item	Value	Parameter			
		CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
Number of input pulses (Low word)	-2147483648~2147483647	#24	#52	#80	#108
Number of input pulses (High word)		#25	#53	#81	#109

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4.
AH04HC-5A supports channel 1~channel 4.

10.9.8 Error Codes

CH1 (*1)		CH2 (*1)		CH3 (*1)		CH4 (*1)	
High word	Low word	High word	Low word	High word	Low word	High word	Low word
-	#26	-	#54	-	#82	-	#110

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4.
AH04HC-5A supports channel 1~channel 4.

The Error codes are described below.
[Description]

Item	Error code			
	CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
The linear accumulation exceeds the range.	16#A001	16#A011	16#A021	16#A031
The scale set exceeds the range.	16#A002	16#A012	16#A022	16#A032
The number of cycles set exceeds the range.	16#A003	16#A013	16#A023	16#A033
The comparison value set exceeds the range.	16#A004	16#A014	16#A024	16#A034

Item	Error code			
	CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
A limit value set is incorrect.	16#A005	16#A015	16#A025	16#A035
The interrupt number set exceeds the range.	16#A006	16#A016	16#A026	16#A036

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

10.10 Troubleshooting

10.10.1 Error Codes

Item	Error code			
	CH1 (*1)	CH2 (*1)	CH3 (*1)	CH4 (*1)
The linear accumulation exceeds the range.	16#A001	16#A011	16#A021	16#A031
The scale set exceeds the range.	16#A002	16#A012	16#A022	16#A032
The number of cycles set exceeds the range.	16#A003	16#A013	16#A023	16#A033
The comparison value set exceeds the range.	16#A004	16#A014	16#A024	16#A034
A limit value set is incorrect.	16#A005	16#A015	16#A025	16#A035
The interrupt number set exceeds the range.	16#A006	16#A016	16#A026	16#A036

*1: AH02HC-5A supports channel 1 and channel 2. It does not support channel 3 and channel 4. AH04HC-5A supports channel 1~channel 4.

10.10.2 Descriptions of the LED Indicators

LED Indicator	Status		Description	Remedy
RUN LED indicator	Green	ON	The module runs.	No action is needed.
		OFF	The module stops running.	No action is needed.
ERROR LED indicator	Red	Blinking	The parameter is set incorrectly.	Read the error code in AH04HC-5A through ISPSoft.
		OFF	No error	No action is needed.